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DEVELOPMENT OF INCENTIVE VALUES IN CHILDHOOD.

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THE USE OF REWARDS AS INCENTIVES TO INFLUENCE BEHAVIOR WAS STUDIED AND AN EVALUATION WAS MADE OF THE INCENTIVE VALUE OF EACH OF THE REWARDS. PORTABLE VERSIONS OF THE WISCONSIN GENERAL TEST APPARATUS WERE USED TO TEST 120 CHILDREN FROM GRADES 1, 3, AND 5. FOR A DISCRIMINATION LEARNING TEST EACH CHILD WAS PRESENTED 5 STIMULI THAT WERE SELECTED FROM 30 PATTERNS PAINTED ON WEDGES. ON EACH OF 80 TRIALS, THE CHILD MOVED ONE OF THE WEDGES AND WAS ALLOWED TO RETAIN THE REWARD HIDDEN IN A CONTAINER PREVIOUSLY COVERED BY THE WEDGE. REWARDS USED WERE A PIECE OF BUBBLE GUM, A PENNY, A SMALL PLASTIC COW, AND A VERBALISM (SUCH AS "FINE, THAT'S THE ONE I LIKE.") AS A CONTROL, ONE CONTAINER HELD NOTHING. FOR THE PAIRED COMPARISONS TESTS, ONLY TWO STIMULI WERE USED IN TWO PROCEDURES--(1) A TEST WITH REWARDS AND (2) A REPEAT OF THE TEST ASKING THE CHILD TO JUST INDICATE THE SELECTIONS MADE IN PROCEDURE 1. RESULTS SHOWED LITTLE VARIATION OF INCENTIVE VALUE IN RELATION TO TASK CONDITIONS, AGE, SOCIOECONOMIC LEVELS, AND INTELLIGENCE. IN GENERAL MATERIAL REWARDS WERE SELECTED IN PREFERENCE TO VERBAL REWARDS. THE MOST PRONOUNCED DIFFERENCE WAS SHOWN IN GRADE 5 WHERE GIRLS SELECTED VERBALS AND BOYS SELECTED PENNIES. INDIVIDUAL DIFFERENCES WERE SIGNIFICANT OVER ALL SAMPLES AND RANKING MEASURES EMPLOYED. THE PAIRED CHOICE APPROACH PROVED TO BE A USEFUL DEVICE FOR DETERMINING THE INCENTIVE HISTORY OF A CHILD PRIOR TO OTHER TESTS. (AL)

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DEVELOPMENT OF INCENTIVE VALUES IN CHILDHOOD

Cooperative Research Project No. 1477

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Storrs, Connecticut

1964

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I. Problem

This report is part of a general research program designed to investigate incentive determinants of child behavior over a wide age range. Since rewards, even in very young children, acquire differential values through learning, it is important to assess incentive strengths children of various ages and other characteristics bring to the psychological laboratory. The program has included, then, the evaluation, as well as the influence, of incentives in child behavior.

Although incentives, rewards, and reinforcements have frequently been employed interchangeably, the former should be carefully distinguished from the latter two. An incentive is a construct representing expectancy of reinforcement or reward. Antecedent to this construct is the definition of a reinforcement or reward condition as an event which increases the probability of response. This increase in probability is the measurable aspect of the incentive construct. Spence (1956) and Logan (1960) have tested expectancy properties of incentives in the animal laboratory, and the former has attempted a careful theoretical exposition of the manner in which incentive habits are learned through classical conditioning in an instrumental conditioning sequence; in this scheme the incentive, added to drive or motivation, interacts with habit strength to determine the final response. At the more complex human levels Rotter (1954) has employed expectancy of reinforcement as part of a major postulate in his social learning theory of clinical psychology, and his students have made impressive contributions to the field of child, as well as clinical, psychology. While the details of the different systems vary somewhat at animal and human levels, the problems and theoretical similarities are quite striking on the centrality of reinforcement for directing and maintaining behavior and on the significance of expectancy in orienting behavior. Not so clear is the role of reinforcement and incentive in acquisition, as contrasted to maintenance or performance, in learning.

Intrinsic to the child training process in our society is the manipulation of rewards to reinforce desirable behavior. Learning basic skills and social values in the classroom is strongly contingent upon the manipulation of incentives by significant figures in the child's environment where teachers exert prominent influence as a consequence of their continuous and proximate supervision of children. The child comes into the classroom with a motivation history of preferred incentives. A general problem for the teacher of elementary school children is to employ various reinforcement procedures which enhance learning; these procedures should be appropriate to the developmental level and motivation history of the child. What has not been systematically investigated is the competition of incentive types to which a child is exposed in and outside the classroom. The child's perception of and selection from these types set the limits within which teachers can manipulate rewards constructively. An innovation in our study is the investigation of reward types (verbalisms, edibles, manipulatables, and tokens) simultaneously as they reflect hierarchical structure and competition in the child's motivation system. Of crucial importance in the classroom is the evaluation of verbal incentives, upon which teachers rely so heavily, in contrast with the other types.

II. Objectives

In the period covered by the present research report, assessment of incentive values by children was undertaken by means of two basic procedures (a) the method of paired comparisons under two conditions and (b) discrimination learning. It was hypothesized that clarification of incentive parameters is a necessary prerequisite for investigating their influence upon and interaction with intellectual and social skills. The following objectives were derived from this general hypothesis.

A. To compare material and verbal incentive values in discrimination learning of elementary school children. Would children learn to select preferred incentive choices from the four reward categories of edibles, tokens, manipulatables, and verbalisms administered under simultaneous and competitive reinforcement in discrimination learning? Would such a procedure, employing subjects as their own controls, provide a satisfactory and economical substitute for the more conventional matched groups approach when comparing material and verbal rewards in discrimination learning? What category and sex differences in reward values would be obtained?

B. To evaluate the method of paired comparisons as a preference scale of incentives and as a measure of individual differences in the incentive history of children. The hypothesis was that preference ranks from the method of paired comparisons and from the discrimination learning task would be comparable, suggesting the former as a psychometric for assessing a child's past incentive history in terms of his present scaled choice selections. The preference ranks from the discrimination learning curves were to provide a criterion for validating the paired comparisons scale which could then be applied to measure individual differences in a child's incentive history. A classroom teacher, as well as an experimenter, might accomodate motivation procedures to defined and relevant individual differences in children's incentives; attempts to modify incentive values could also be measured.

C. To analyze age trends (6 to 10) in incentive values of elementary school children. It was hypothesized that rewards of various types have some intrinsic incentive value, such as novelty and drive reducing qualities, and that they also have culturally derived learned extrinsic value which might be expected to change with age. It was further hypothesized that the value of the verbal incentive, relative to the material, would increase with age and possibly even surpass the values of material incentives. Published research ranges from favoring the material rewards to some equivocation in findings suggesting the need for further investigation in order to explain the inconsistencies. Obviously more research is needed since the use of verbal incentives and other symbolic rewards represents a prime classroom motivation device. The conditions which maximize the effectiveness of verbal rewards need careful experimental scrutiny.

D. To analyze incentive choices over trials in discrimination learning. With continued exposure to four reinforcement types over

trials in this experiment, the subjects might employ various strategies in responding to incentive expectations; these might include systematic alternation, satiation, maximization of particular types, etc. This particular objective was frankly exploratory; our intuitions suggested a satiation hypothesis for modal subjects who might switch from a cumulated "kitty" of first preferred incentives to next preferred and so on. Individual strategies could only be guessed.

III. Related Research

Incentive Preferences via Paired Comparisons and Discrimination Learning

In earlier studies (Tyrrell, Witryol, & Silverg, 1963; Witryol, & Alonzo, 1962; Witryol & Fischer, 1960; Witryol & Ormsby, 1961) the method of paired comparisons was demonstrated to be a stable and useful procedure for scaling various reinforcement types commonly employed in experimental work with young children and mental retardates. The rewards evaluated were samples of four categories (edibles, tokens, manipulatables, and verbalisms) suggested by Bijou and Sturges (1959) from their review of the literature on positive reinforcers. Although paired comparison preference findings were in a general way congruent with reward values noted in learning research with children, the need for a more direct test of the validity of this approach was indicated. In defining "preference," Irwin (1961) has emphasized the disposition to act, reserving the term "latent preference" for the disposition alone unaccompanied by an active desire. The paired comparison technique seemed to reflect active preference choices by our subjects, but a more active approach via discrimination learning would serve to confirm or reject activity involvement. With the latter technique, the children had to solve a complex discrimination to obtain and continue to cumulate (maintain) desired rewards.

Discrimination learning and performance was selected as a convenient vehicle for studing reward preferences. It constitutes a basic form of problem solving, and beyond that, as conventionally employed in laboratory learning studies, it involves a preference choice between two or more stimuli (Lawson, 1960). Typical of the procedure and results, Terrell and Kennedy (1957) studied size discrimination by children of two age groups and reported candy to be higher in incentive value than other reward categories which included verbal praise; no age trends (4 to 5 versus 8 to 9) were discovered. To take account of individual differences Brackbill and Jack (1958) tested young children on a position alternation discrimination with size and color as the irrelevant cues; less variance was found for those subjects who were able to preselect preferred rewards compared to those who responded to experimenter determined rewards.

Reward Types and Deprivation

Since an early study of maze learning by Abel (1936) it has been widely assumed that material rewards are more effective than verbal rewards for inducing learning by children. Abel's "material" reward, however, was money which may have derived token and other symbolic characteristics. Terrell, Durkin, and Wiesley (1959) reported a socioeconomic parameter interacting with reward types in discrimination learning; middle class children were more sensitive to symbolic (light signal) reinforcements in contrast to lower class children who were relatively more responsive to material (candy) reward. The authors hypothesized a deprivation phenomenon to explain the heightened material incentive influence for the lower class children, while noting that middle class children learned from signals of progress.

The enhancement of social reinforcement as a function of social deprivation was established by Gewirtz and Baer (1958a; 1958b) in a frequently cited research program. The strong impact of social deprivation compared to other stimulus deprivation was confirmed in a subsequent study (Stevenson & Odom, 1962); in a later investigation (Hill & Stevenson, 1964) sensory, as well as social, deprivation effects suggested many aspects of the phenomenon. Following this line of reasoning in a recent investigation, Lewis, Wall, and Aronfreed (1963) compared the effects of verbal social approval with an instrumental light signal reinforcement on probability learning over age. Younger children maximized under verbal approval, but older children did not, confirming the authors' hypotheses of social dependence for the former group in contrast to an internalized need to be correct for the latter group. McCullers and Stevenson (1960) found a similar need for approval in their young subjects on a probability learning task; older subjects performed for material reinforcement (marbles) and a corollary inferred (by the authors) responsiveness to playing the game correctly. Finally, Zigler and Kanzer (1962) found lower class children tended to respond to verbal praise reinforcement, while middle class children were more sensitive to a verbal denotation of being correct; they interpreted the latter group to be more cognitively sensitive to the "tertiary" reinforcement, being correct, as a possible function of more advanced reinforcement history. Zigler (1963) has conducted a vigorous and extensive research program on the properties of social deprivation as a stable mediating mechanism deriving from the reinforcement history of normal and mentally retarded children in contradistinction to brief social deprivation operationally generated and defined in the Gewirtz-Baer paradigm.

Parameters in Incentive Research

Implicit in our review thus far has been a number of parameters to consider when generalizing about incentive influences in children's learning: (a) definition of reinforcement, e.g., Abel's "material" reward; (b) definition of verbal approval, e.g., being correct versus social approval; (c) drive relevance of reinforcement; (d) nature of the dependent variable, ranging over various measures of learning and performance; (e) age and social class of population. The fourth factor merits special consideration when discrimination learning has been used as the dependent variable. Whereas differential incentive effects have been demonstrated for measures of performance, it is difficult, if not impossible, to find research confirming such differential influences on measures of acquisition in discrimination learning. Terrell's research provides a notable exception with some equivocations; he did find some differential influence upon acquisition in discrimination learning. Cross and Boyer (1964) discovered amount of reward to be a significant source of variance in animal learning as defined by an errors measure on a Y maze; they emphasized the complex nature of the task and the infrequency of similar findings in the literature. On the other hand, Miller and Estes (1961), investigating incentive effects upon discrimination learning in children, found knowledge of results more potent than a penny or fifty cents with no differences between the last two; they generalized, perhaps prematurely, (p. 503), "The no-difference results repeatedly found in comparative studies of incentive variation in visual discrimination are further substantiated by these results on human Ss." Need achievement was demonstrated

to be a significant interacting variable.

The problem of incentive effects upon learning and performance was most instructively reviewed by Pubols (1960) who extracted critical considerations from findings in the animal laboratory. He cited a useful distinction suggested by Lawson (1957) in designating the "absolute" method when a subject experiences only one value in an experiment, as contrasted with the "differential" method when the subject experiences more than one incentive value; Meyer (1951) had carefully noted the necessity for animals to experience a range of rewards in order to demonstrate incentive effects. The influence of incentives upon performance, or time measures, was discovered by Pubols in a large number of studies, but learning, or time-independent measures, was not frequently found to be modified. Logan's (1960) animal research and incentive model is based primarily on performance measures, and he has made a strong case for the intimate interrelationships between performance and learning (pp. 241-242). Pubols pointed out, however, that where influences upon learning were discovered, the differential method was employed, and he urged continued research. Spence (1956) also suggested research along these lines emphasizing careful control of the habit factor; a recent demonstration of the efficacy of reward magnitude in modifying performance, independent of the size of the reward with which the original wqs paired, has emerged from his laboratory (Goldstein & Spence, 1963). A salutory example of this approach is the differential method employed by Davenport (1962) with animals in spatial discrimination; he developed "equal-reinforcement contours" from his findings which reflected balance between a unit increase in reinforcement delay and a log unit increase in reinforcement magnitude. Finally, Pubols' review contains a summary of animal researches where the method of paired comparisons was used to evaluate incentive quality and quantity. This procedure, as well as the differential method, has been employed in our own program.

Another knotty problem about the nature of experimentation with incentive influences in childhood merits consideration, namely, the informational versus the motivational aspects. White (1963) has recently reviewed some of the research on the informational function with children, which is too elaborate to be detailed here. Ware and Terrell (1961) designed an ingenious delay experiment to distinguish between associative and motivational features of reinforcement, using kindergarten and first grade children, but only the former factor was confirmed. Shepp (1962; 1964) has demonstrated the powerful associative features of the incentive in not only facilitating the discrimination of relevant stimulus dimensions by mental retardates, but also in impairing learning by focusing attention upon irrelevant stimulus attributes. Longstreth (1962) tested the effects of reinforcement upon instrumental response strength in a study where young children learned to run faster in a life size alley to a goal box previously associated with candy, but the investigator could not attribute the incentive expectation speed facilitation to either associative or motivational properties of the reward; both or one of these mechanisms might have mediated. Spence's incentive theory (1956) includes both the associative and

motivation features without clear distinctions in his symbolic mathematical formulation for the factor, K. He seemed to have been particularly interested in the motivational aspect when discussing instrumental conditioning. In this connection Terrell (1959) has observed that the explorations and manipulations in problem solving, as defined by conventional discrimination tasks, represent the sufficient reinforcement values.

Theory and research suggest the operations of incentives in many different ways. We have already mentioned (a) the associational or informational characteristic which may represent merely a reinforcement signal. Certain signals may be differentially effective as a function of individual differences in (b) the need to be correct. Material and nonmaterial incentives may also possess (c) intrinsic and derived motivational value which are enhanced or depressed by (d) relevant drive states like social or sensory deprivation or satiation. One general class of reinforcements, not clearly specified, may derive from (e) exploration and manipulation needs in problem solving. Any one or all of the foregoing may interact with the nature of the experimental task, as, for example, along a dimension of complexity.

Age and Incentive Valuation

Jeffrey and Skager (1962) tested the influence of incentive conditions upon the tendency of children at two age groups (age 7 versus age 10-8) to generalize indiscriminately to peripheral light signals. They hypothesized that young children frequently fail to understand experimenter goals and require tangible reinforcement for responding to instructions. When the younger subjects received poker chips to be traded for movie attendance, performance improved beyond effects of verbal encouragment for speed of response; older subjects did not show facilitation from receiving poker chips, since they appeared to respond to verbal reinforcement. Although the main intent of the experiment was to demonstrate heightened drive as a consequence of greater incentive, the authors concede the possibility that the poker chips may have served to reinforce more careful attending responses relevant to the instructions. They distinguish between reinforcement, which serves as a cue, and incentive effects of a reward which increases drive, but they failed to discover this difference by definition of the operations in their study. One possibility they neglected to mention explicitly was the internalization, suggested by others, of the need to be correct in older subjects.

A cognitive approach to the narrowing of attention consequences of incentive motivation is contained in a research by Smock and Rubin (1964) who studied recognition of complex figures in 9 to 12 year old children. In the experimental condition subjects were promised toys, and this incentive increased accuracy while reducing uncertainty, motivational arousal being interpreted as organizing and narrowing attention for relevant cues. Deriving their hypotheses from a similar theoretical framework, Kausler et al. (1963) reported opposite findings employing serial anticipation learning of geometric forms by seventh and eighth grade children as a function of monetary reward. The incentive maximized learning of an

irrelevant cue, color. The same experiment with college students had resulted in maximization of relevant cues. From the results and post experimental interviews, these investigators concluded that children, in contrast to adults, are prone to a generalized set for all cues, with the incentive magnifying this tendency. It seems possible that the Smock and Rubin task had less cue variability, making the incentive more directly relevant to task solution. Our own research experience suggests that the incentive becomes relevant and effective insofar as it's relationship to the task problem is understood clearly and spontaneously by the child or is made explicit as a function of experimental instruction specificity.

Stevenson and Weir (1961) reported differential reinforcement influences with age from a series of three choice discrimination problem studies. Between ages three and seven there was an increasing tendency for children to change responses following either reinforcement or nonreinforcement of a previous response. The authors suggest that younger children "stay" with a reinforced response, while older children switch as if to scan the contours of the problem in order to test verbal hypotheses. This represents another example of problem interaction with incentive utilization as a function of age.

An age function not easily rationalized was reported on discrimination learning in children by Horowitz (1963) who found a buzzer reinforcement more effective at the preschool level, a verbal social reinforcement superior from the first to the fourth grades, and no differences at the fifth and sixth grades. The inconsistencies with social deprivation theory at the early age levels is difficult to explain. Horowitz made the interesting observation that the social reinforcer seemed more effective in early, rather than in late, stages of learning.

Another direction of verbal social reinforcement effects was indicated from the findings of Sullivan (1960) who tested verbal reward and punishment influences upon a simple concept elicitation task, identification of pictured humans and toys, over a wide age range, 5 to 11. In general verbal punishment was superior over all age groups with no developmental trends, but verbal reward showed striking changes with age; no effect was found at age 5, statistical significance was approached at ages 7 and 9, and significance was clearly attained at age 11. Sullivan explained his findings in terms of differential reinforcement history, younger subjects being earlier and more frequently exposed to negative than to positive verbal procedures. Task relevance interaction with reinforcement is also suggested for this particular concept formation task requiring generalization as well as the simple discrimination employed in so many studies reviewed here.

The enhanced value of verbal reinforcement with age was demonstrated by Witryol and Ormsby (1961) employing a simple preference scale for 120 children. Six incentives--a token, two edibles, and two verbalisms--were presented in paired comparisons to three age groups, 5, 8, and 11, for preference choices. Scaled incentive values reflected marked shifts in the verbalisms from lowest rank, at the youngest, to highest, at the two

oldest, age levels. A critical feature to be noted was the nature of the instructions which required the children to respond to, "Now, if you had done something very well indeed, would you rather have your mother or your teacher give you _____ or _____?" It might be concluded that the obtained incentive hierarchy was strongly contingent upon the reinforcement values associated with specific expectations implicit in the motivational set. Under these circumstances the more abstract and internalized verbal incentives gain primacy with age for those developmental tasks involving accomplishment under the supervision of adults, doing "something very well indeed."

Most related to the present research project is a recent study by Nickell and Travers (1963) who tested material and verbal reinforcements, on 50% of the trials, upon a four choice spatial discrimination task over five age levels from nursery school to grade 9. Material reinforcement was superior at all age levels, and the curves over 120 trials for the total population were strikingly similar to those obtained in our present investigation. No main effects with age were found, however, although a subanalysis suggested the verbal reward to be more reinforcing for nursery than intermediate grade females. The authors' explanation implies a verbal reinforcement satiation factor as well as a novelty effect for the material reward deriving from the mechanical delivery of marbles. To this one might again add the parameter of task relevance. Incentive items, like candy and toys, were clearly visible to the subjects and dispensed for participation at the end of the session. It seems quite possible that the children interpreted the acquisition of marbles as token trade material for the incentive objects, a transaction not so clearly apparent for a verbal reinforcement like "good."

Final Considerations

From this review one may infer that rewards or reinforcements possess cue and motivation properties. It seems plausible to conclude that the first property must be clearly apparent to the subject as related to the experimental task. Next, the incentive or motivation property tends to heighten drive, but a generalized drive increment does not appear sufficient to explain varied findings on children. A relevant drive increment seems more compelling. The incentive should be relevant to the task and to the particular motivation the child brings to the experimental session or to the drive induced by the conditions of the experiment. After all, incentives and motives of children are highly derivative and learned. Apparently contradictory findings may be reconciled by this view.

IV. Method

Subjects

The population for the main experiment consisted of 120 children, 20 boys and 20 girls in each of Grades 1, 3, and 5, at approximate ages 6, 8, and 10, respectively; mean IQ's ranged from 117 to 125 as shown in Table 1. The modal occupational status of fathers for this population

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Insert Table 1

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was professional. Two reference groups of lower socioeconomic status, 20 boys at Grade 1 and 20 girls at Grade 5, were also studied. Modal occupation status of fathers was manual worker, and subject mean IQ's ranged from 102 to 104.

Procedure

Two portable versions of the Wisconsin General Test Apparatus were employed by two male Es in local schools. E, separated from S by a one-way screen, presented each child with five stimuli covering five receptacles baited with the rewards. The five stimuli (Figure 1) were non-

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Insert Figure 1

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sense planometric figures, different in color, painted on white cards, mounted on 4-inch square wedges, and, for each child, randomly selected from a pool of 30 patterns. The rewards were a piece of bubble gum (edible), a penny (token), a small, natural colored plastic cow (manipulatable), and a verbalism, such as, "Fine; that's the one I like." For each S reinforcements were randomly assigned to the five stimulus patterns which, in turn, were randomized for position over 80 trials. S was required to choose (move) one of the five wedges with its nonsense drawing on each of the 80 trials, and he was allowed to put the associated material reinforcement in a paper bag, cumulating rewards over trials. For one of the five stimuli no reinforcement was given, this condition serving as a control. Since the five stimuli and associated rewards were constant for a given child and randomized among children, scores for each S were choice frequencies of the four rewards and the control over trials, reflecting his disposition to rank the incentive types, a process which may be called discrimination preference choice behavior.

Prior to the discrimination task, the incentives were presented by the method of paired comparisons under two different conditions: first, by the child's preference indication (pointing) and, second, by his cumulation of the rewards (consummation). At the end of the 80-trial discrimination preference task, a recall procedure to test learning was

Table 1

Age and IQ Characteristics of Each Experimental Group

(N=20 per group)

Group	Age in months		IQ	
	M	SD	M	SD
Upper socioeconomic class				
First grade:				
Males	77	4.1	117	9.5
Females	76	3.7	118	9.7
Third grade:				
Males	101	4.8	125	13.0
Females	99	3.8	123	11.3
Fifth grade:				
Males	122	5.7	121	12.4
Females	123	4.4	118	6.7
Lower socioeconomic class				
First grade:				
Males	81	5.6	104	13.5
Fifth grade:				
Females	131	6.6	102	8.4

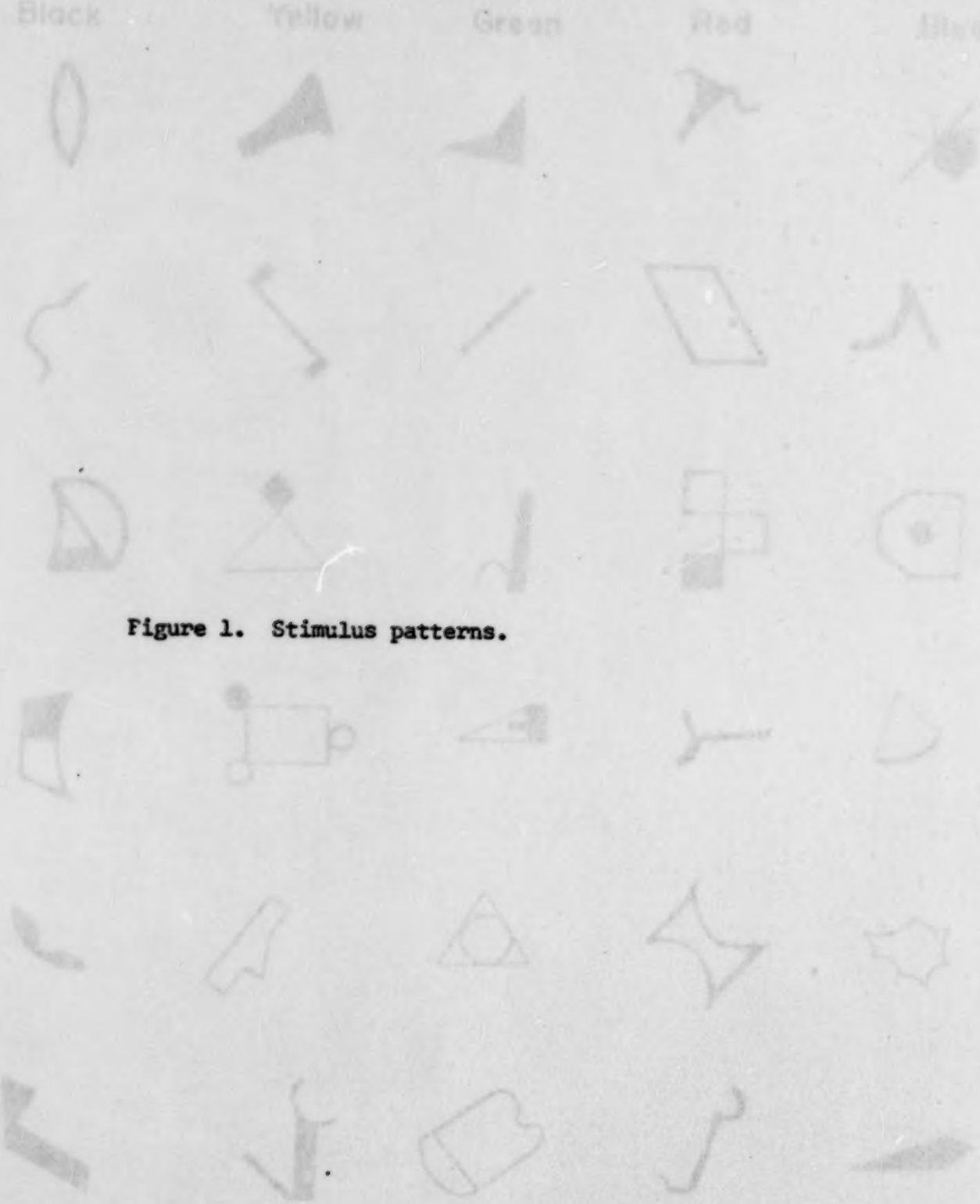
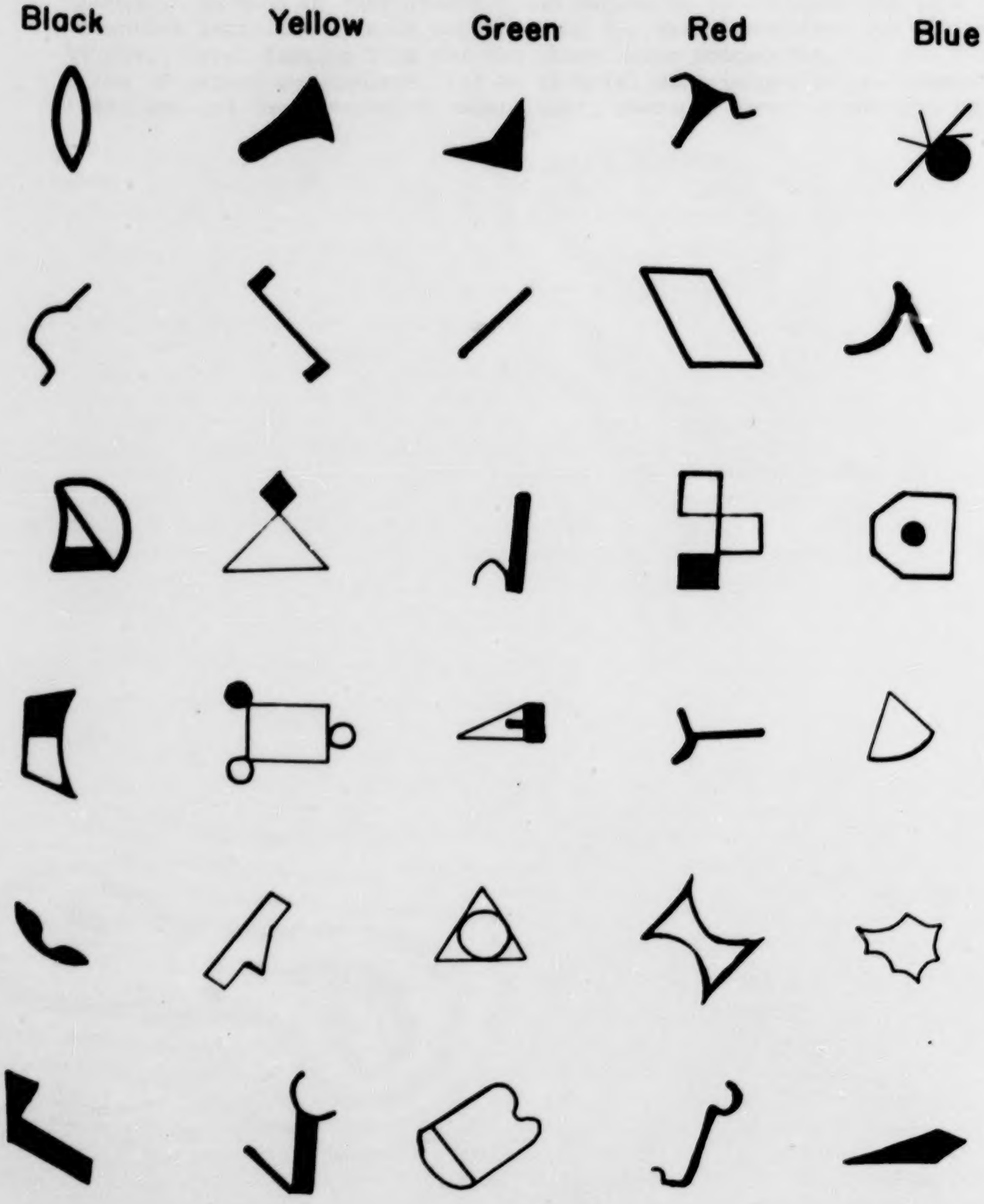


Figure 1. Stimulus patterns.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Red
Blue

invoked. On each of five trials S was requested to indicate the five incentive locations without confirmation for each identification within trials. Total testing time for the three basic procedures, (a) two versions of paired comparisons, (b) an 80-trial discrimination preference task, and (c) the five-trial recall test, averaged about 40 minutes per S.

V. Results

Discrimination Preference Choice Behavior

Learning

Incentive choices via the discrimination learning task followed a highly similar pattern for sex and the three age groupings as demonstrated in Figure 2 where the data are plotted over four blocks of 20

Insert Figure 2

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trials per block for the main experiment. In general, material incentives were chosen most frequently followed by the verbal incentive with the control condition, nothing, last. Since subjects within groups were exposed to all of the reinforcement conditions simultaneously in the experimental operations, the data lacked independence for conventional analysis of variance treatment between incentives; however, age, sex, and trial block effects could be analyzed by conventional treatments. Table 2 contains a summary of only the statistically significant findings

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Insert Table 2

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from the numerous analyses performed.

Close examination of Table 2 demonstrates evidence of learning by reason of trial block changes for selected incentives at all grade levels. Taken together with Figure 2, the most compelling uniformity is the significant decline in the control condition for all groups. Other trial block effects indicated are increases in charm and bubble gum with decrease in verbal for Grade 1, increase for charm in Grade 3, and increases for penny and verbal (girls) in Grade 5. A particularly clear demonstration of these learning effects has been presented in a preliminary report on Grade 5 (Witryol, Tyrrell, & Lowden, 1964).

Another way to analyze learning effects was derived from analysis of incentive ranks for the first trial block and for the last two trial blocks combined. The first 20 trials yielded data for early learning, and the last 40 trials appeared to reflect stabilization of final performance. Friedman's two-way analysis of variance by rank (Siegel, 1956) was computed on measures of final performance for (a) all conditions, (b) all conditions minus the control, nothing, and (c) the three material incentives; similar computations were made for measures of early learning. Results are summarized in Table 3. Inspection of Figure 2 should clarify

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Insert Table 3

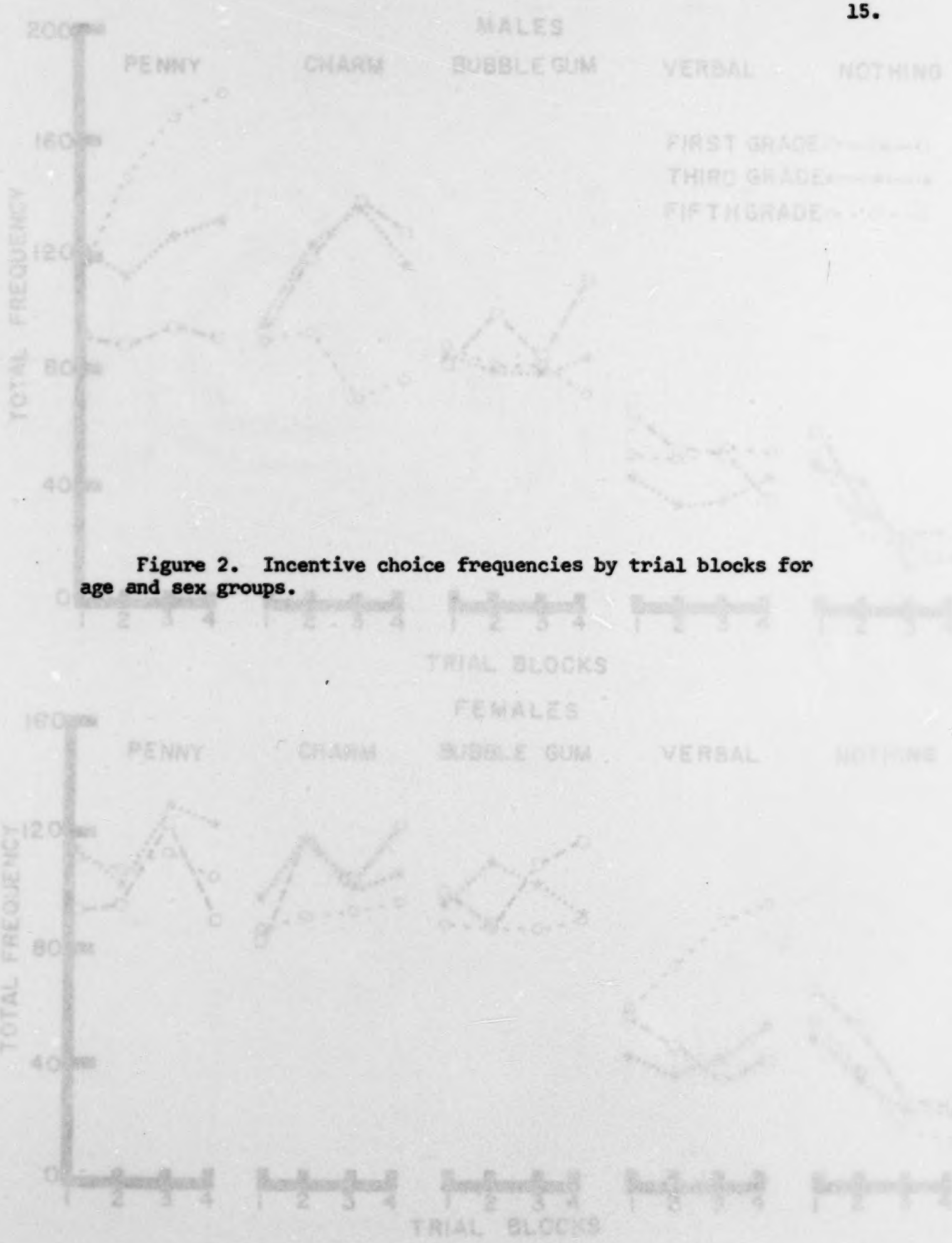

Figure 2. Incentive choice frequencies by trial blocks for age and sex groups.

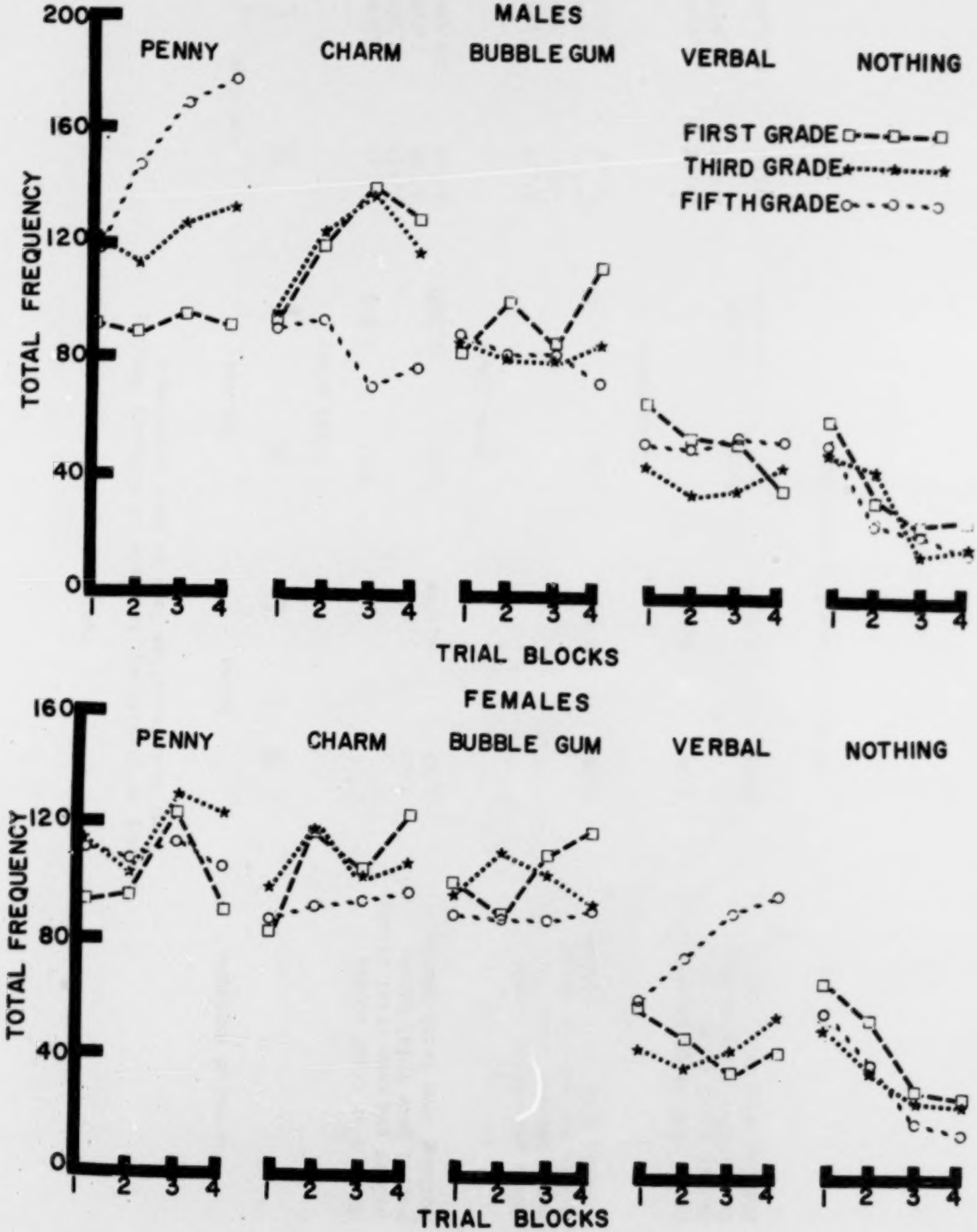
MALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
FIRST GRADE
THIRD GRADE
FIFTH GRADE
TOTAL FREQUENCY
200
160
120
80
40
0
1 2 3 4
TRIAL BLOCKS
FEMALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
TOTAL FREQUENCY
160
120
80
40
0
1 2 3 4
TRIAL BLOCKS

Table 2

Summary of Significant Analysis of Variance Results for Discrimination Task in Main Experiment

Source of variance	Males		Females		Combined	
	df	F	df	F	df	F
First grade						
Charm over trial blocks			3/57	3.83*	3/114	4.55**
Bubble gum over trial blocks					3/114	2.99*
Verbal over trial blocks	3/57	3.80*			3/114	5.05**
Nothing over trial blocks	3/57	8.98**	3/57	13.19**	3/114	20.75**
Third grade						
Charm over trial blocks					3/114	3.28*
Charm between sexes					1/38	7.63**
Bubble gum between sexes					1/38	5.80*
Nothing over trial blocks	3/57	17.26**	3/57	4.48**	3/114	18.08**
Fifth grade						
Penny over trial blocks	3/57	5.16**			3/114	3.98**
Penny, sex X trial blocks					3/114	4.94**
Verbal over trial blocks			3/57	3.95*		
Nothing over trial blocks	3/57	13.98**	3/57	25.13**	3/114	28.40**

(Table continued on next page)

Source of variance	Males		Females		Combined	
	df	F	df	F	df	F
			All grades combined			
Penny over trial blocks	3/171	3.23*	3/171	3.06*	3/342	4.62**
Penny over grades	2/57	4.68*			2/114	4.22*
Penny over grades, last 40 trials	2/57	5.13**				
Charm over trial blocks	3/171	3.06*	3/171	4.12**	3/342	5.93**
Charm over grades					2/114	4.02**
Charm over grades, last 40 trials	2/57	4.52*				
Charm, grade X trial blocks	6/171	2.32*			6/342	2.22*
Verbal over grades					2/114	3.96*
Verbal over grades, last 40 trials			2/57	3.54*		
Verbal, grade X trial blocks			6/171	20.02**		

Note - Subject variances within each experimental group, highly significant for nearly all incentives, are excluded from this table. All such significant results reflect heterogeneity of preference for the various incentives among Ss within a particular group.

*Significant at .05 level.

**Significant at .01 level.

Table 3

Summary of Results of Friedman Two-Way Analysis of Variance (χ^2_r) and Kendall's Coefficient of Concordance (W) for Discrimination Ranks

(N=20 per Age-Sex Group)

Measure	Males		Females	
	χ^2_r	W	χ^2_r	W
	First grade			
Last 40 trials:				
All incentives	34.85[c]	.44[b]	41.71[c]	.52[b]
All incentives except "nothing"	19.86[c]	.33[b]	21.54[c]	.36[b]
Material incentives	3.23	.08	.23	.01
First 20 trials:				
All incentives	6.61	.08	12.47[a]	.16[a]
All incentives except "nothing"	5.13	.09	10.02[a]	.17[a]

(Table continued on next page)

	χ^2_n	W	χ^2_r	W
		Third grade		
Last 40 trials:				
All incentives	38.64[c]	.48[b]	31.04[c]	.39[b]
All incentives except "nothing"	19.19[c]	.32[b]	11.63[b]	.19[b]
Material incentives	7.68[a]	.18[a]	1.58	.04
First 20 trials:				
All incentives	29.69[c]	.23[b]	18.88[c]	.27[b]
All incentives except "nothing"	17.66[c]	.29[b]	12.09[b]	.20[b]
		Fifth grade		
Last 40 trials:				
All incentives	30.76[c]	.38[b]	20.93[c]	.31[b]
All incentives except "nothing"	13.79[b]	.23[b]	.38	.01
Material incentives	12.08[b]	.30[b]	.48	.01
First 20 trials:				
All incentives	24.35[c]	.30[b]	15.77[b]	.20[a]
All incentives except "nothing"	13.42[b]	.22[b]	12.25[b]	.20[b]

[a]Significant at .05 level.
[b]Significant at .01 level.
[c]Significant at .001 level.

the strategy. Within a particular age-sex group, rank significance for all incentives early and late in learning required analysis, but one might attribute significance to the uniformly low rank of the control condition. Eliminating this last condition permits interpretation of incentive ranks per se, and finally, analysis of the material incentive ranks separately was suggested from their characteristic tendency to bunch for the different populations.

As it can be seen from inspection of the chi square values in Table 3 for the first grade, statistical significance on the last 40 trials was established for various rank sets, except the obviously grouped material incentives. On the first 20 trials significant values were obtained only for the females, and the values are considerably smaller than for the terminal learning measures. A derivation from Friedman's test yielded rank agreement measures, Kendall's coefficient of concordance W, also presented in Table 3, to depict group consensus on incentive ordinal locations which must have resulted from learning the incentive-relevant stimulus locations. The W measures were consonant with the chi square values at all grade levels.

Statistical significance is demonstrated in the third grade for all analyses in Table 3. Learning evidently took place by the end of the first trial block, as well as on the terminal two blocks. Ordinal rank significance was even obtained for the closely spaced material rewards. Similar findings are apparent for the fifth grade with one provocative exception; significance fails on the terminal trial blocks for females when the control condition is eliminated. The major factors to account for this can be seen in Figure 2 by reason of the sharp increase over trials for verbal, reaching the same level as the already closely spaced material reinforcements.

A rigorous test of learning was the five trial recall measure at the end of the discrimination task when the children were required to make identifications for the 25 possibilities of matching the hidden reward with the correct stimulus. The frequency distribution in Table 4 suggests high accuracy for all samples save one, lower social status

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Insert Table 4

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first grade boys. This exception may be a function of low MA in relationship to the demands of the discrimination task. The great majority of the subjects obtained perfect scores, and even the lower class boys, in 16 of 20 subjects, identified at least one incentive on five test trials; chance probability for such performance would be 5 in 3125.

Individual Differences

As noted at the bottom of Table 2, but not recorded in detail, significant subject variances, strongly reflecting individual differences, were obtained from the multiple statistical analyses; subject

Table 4

Performance Distribution on Five Trial Terminal Recall Tasks for Each Sample

Correct choices	First Grade		Third Grade		Fifth Grade	
	Males	Females	Males	Females	Males	Females
Upper socioeconomic class						
21 to 25	14	15	17	17	19	18
16 to 20	1	2	0	1	0	1
11 to 15	4	2	2	1	1	1
6 to 10	1	1	1	0	0	0
1 to 5	0	0	0	1	0	0
Lower socioeconomic class						
21 to 25	10					18
16 to 20	1					2
11 to 15	4					0
6 to 10	1					0
1 to 5	4					0

variances on each incentive condition including the control reflected .01 probability levels or better with one exception at the .05 level. The nature of these individual differences is graphically depicted in Figures 3, 4, and 5 for the main experiment, where choice frequency

Insert Figures 3, 4, and 5

intervals for incentive conditions on the terminal 40 trials are plotted against subject frequencies. The modal subjects for most age-sex groups are located at the first plotted point of lowest frequency. This point practically exhausts the variance for the nothing and verbal conditions, except for the verbalism in Grade 5. Turning attention to the material incentives, the points on the abscissa following the first one tend to carry the variance, generally at the second plotted point with diminishing frequencies thereafter. The rectilinear distribution on penny for fifth grade boys departs from this generalization. The total pattern emerging from statistical analyses, graphic inspection, and the standard deviations in the last few columns of Table 5 reflect the impact of individual diffe-

Insert Table 5

rences in the development of derived incentive values.

The overall pattern from Figure 2 suggests few sex differences, each population serving as an approximate replication for the other, and this is confirmed from the statistical analyses in Table 2. The sex populations in the first grade practically replicate each other; where trial blocks statistical analyses fail significance in one sex, but not the other, the combined calculations suggest comparable trends. In Grade 3, boys tended to prefer charms while girls preferred bubble gum as compared to the opposite sex frequency choices, but similar ranks were maintained within each population. The most pronounced differences obtained in the fifth grade where the penny over trial blocks--sex interaction favored boys, while a trial block increase for verbal was statistically significant only for the girls. It should be observed that the verbal incentive for boys did not decline over trials, as had the control condition in the fifth grade; this was also true for both sexes in the third grade; only in the first grade did the verbal incentive for the sexes combined decline over trials.

Agreement and Consistency within and between Methods of Ranking Incentives

The mean raw scores from Table 5 were transformed to ranks and appear in Table 6. Kendall's coefficient of concordance W has already

Insert Table 6

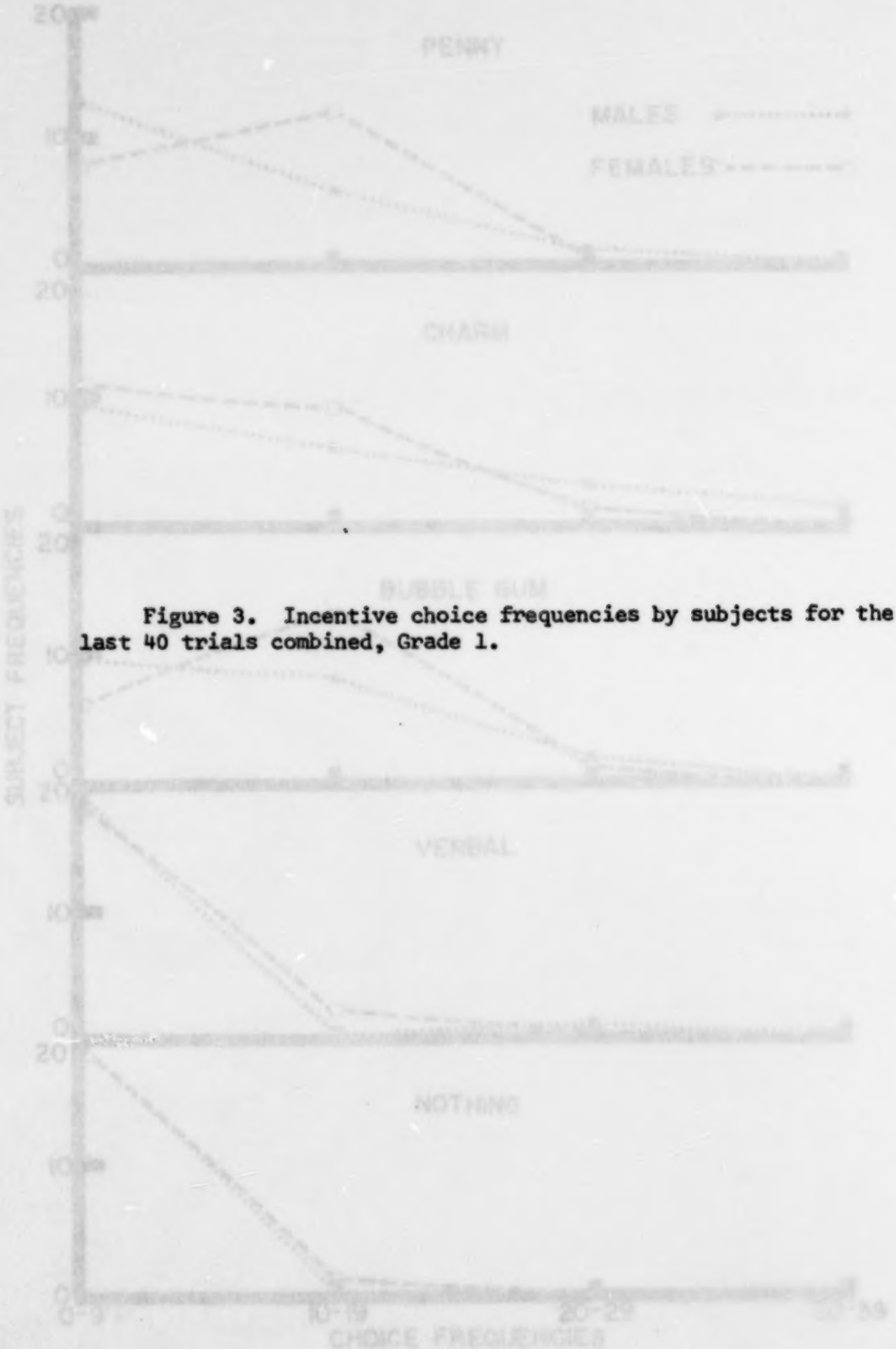
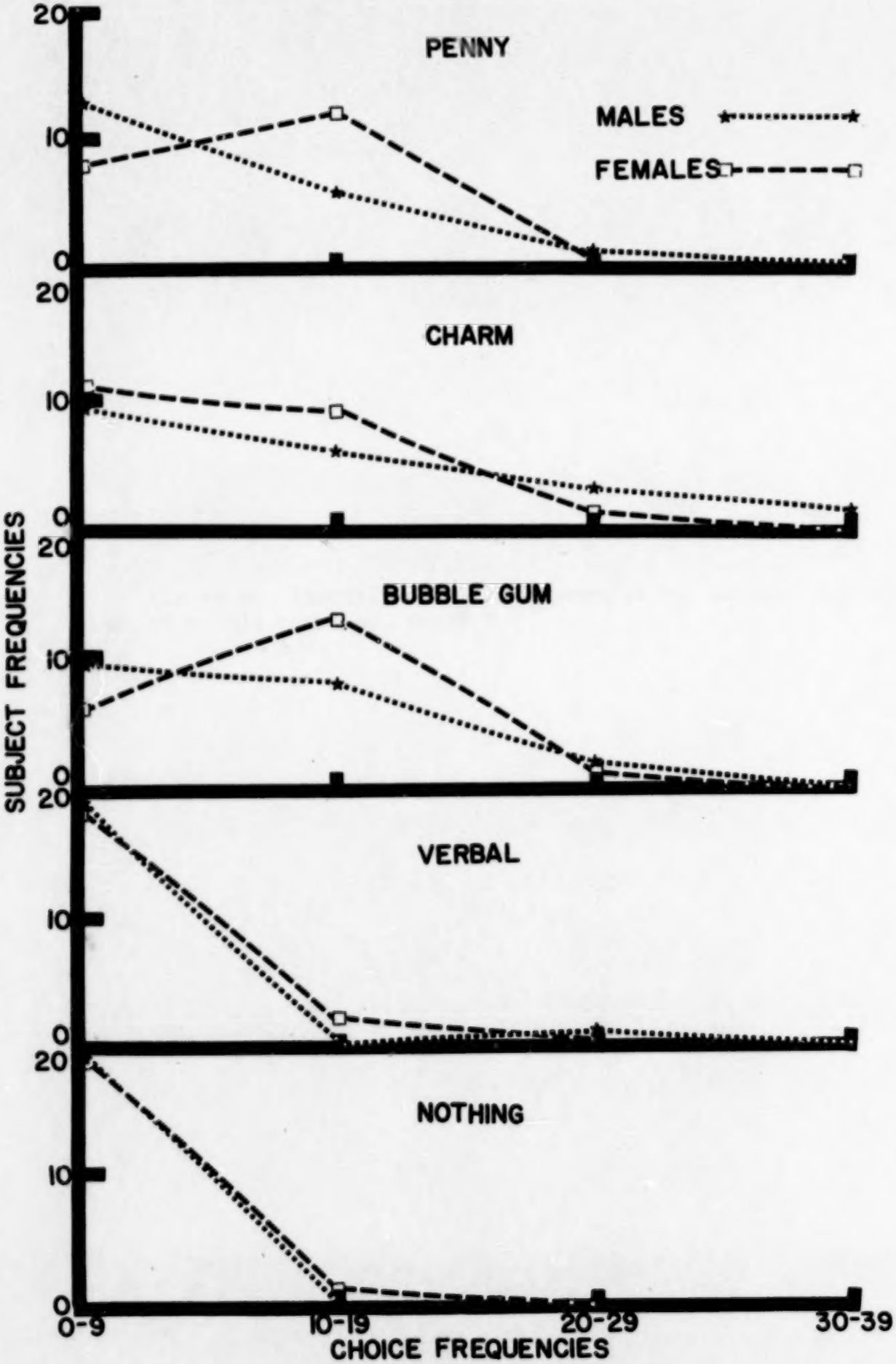


Figure 3. Incentive choice frequencies by subjects for the last 40 trials combined, Grade 1.


PENNY
MALES
FEMALES
CHARM
BUBBLE GUM
VERBAL
NOTHING
SUBJECT FREQUENCIES
20
10
0
0-9
10-19
20-29
30-39
CHOICE FREQUENCIES

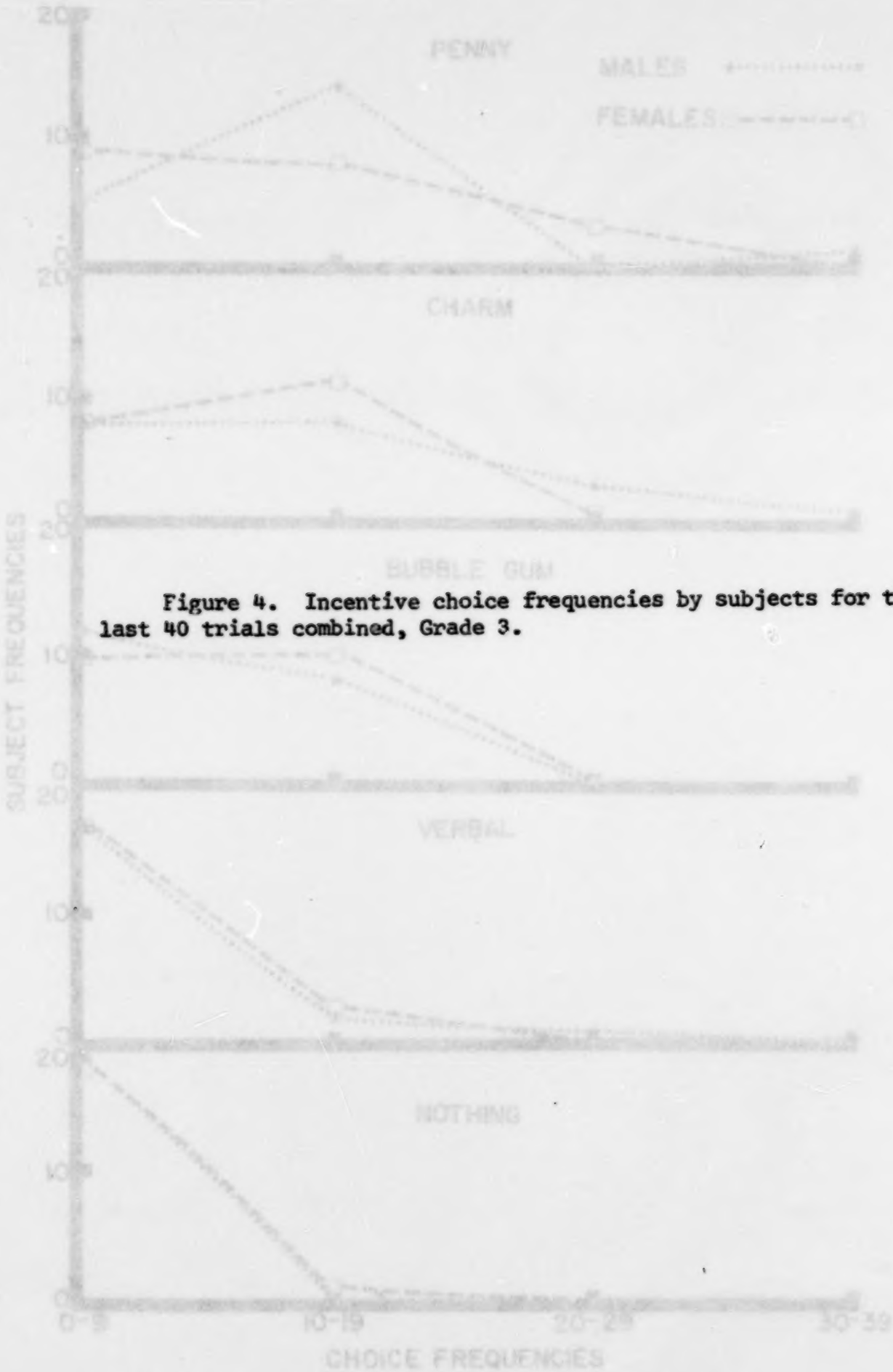
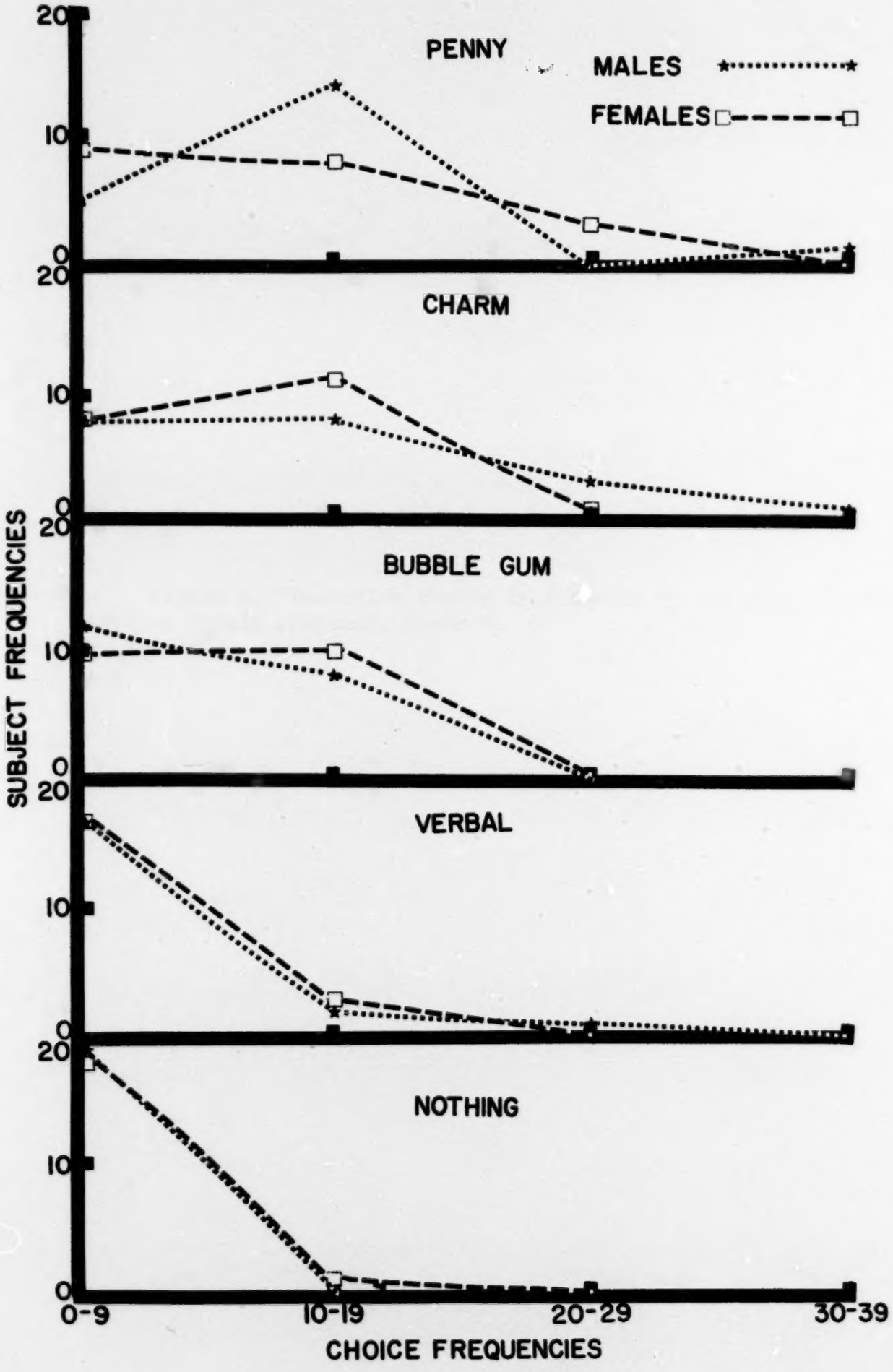


Figure 4. Incentive choice frequencies by subjects for the last 40 trials combined, Grade 3.


PENNY
MALES
FEMALES
CHARM
BUBBLE GUM
VERBAL
NOTHING
SUBJECT FREQUENCIES
20
10
0
0-9
10-19
20-29
30-39
CHOICE FREQUENCIES

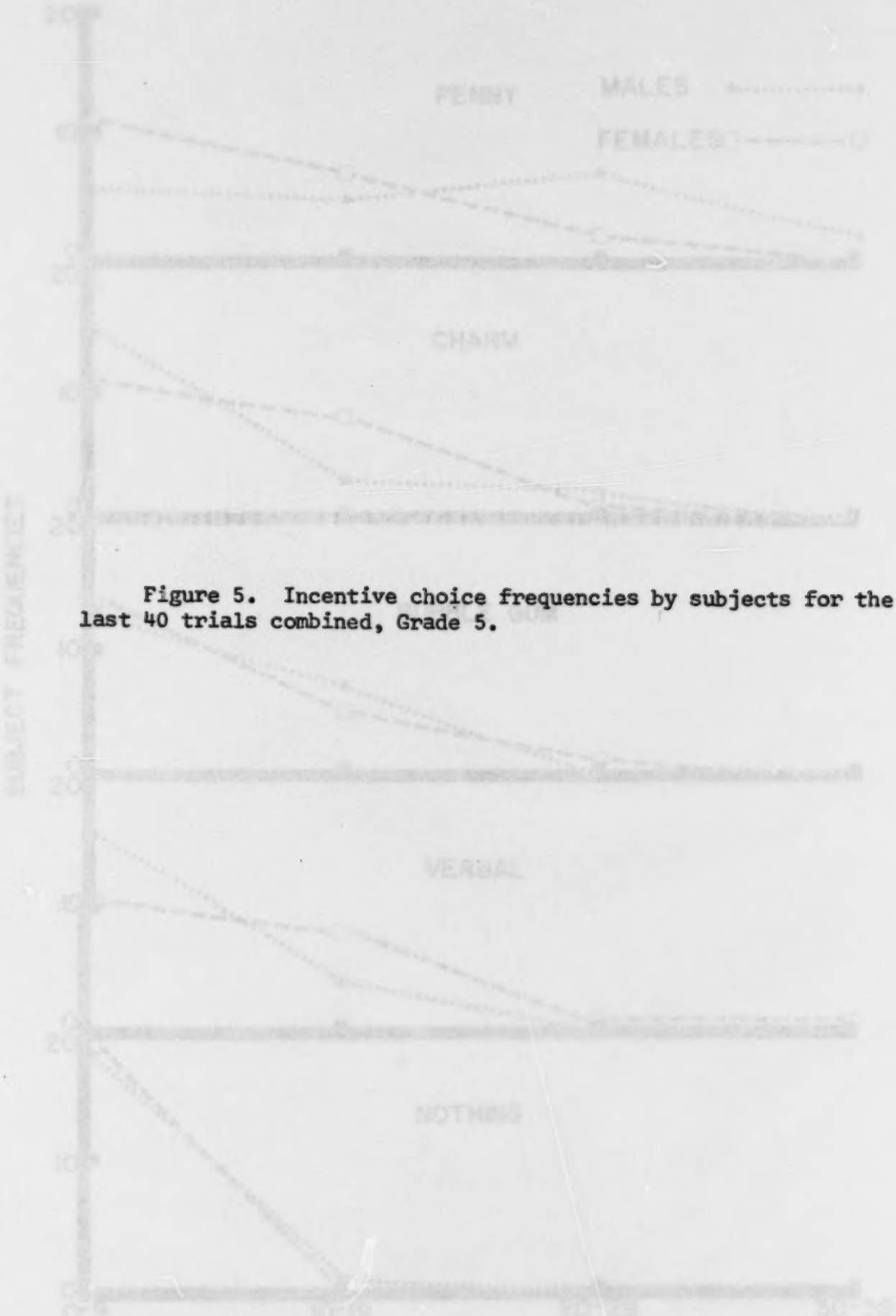


Figure 5. Incentive choice frequencies by subjects for the last 40 trials combined, Grade 5.

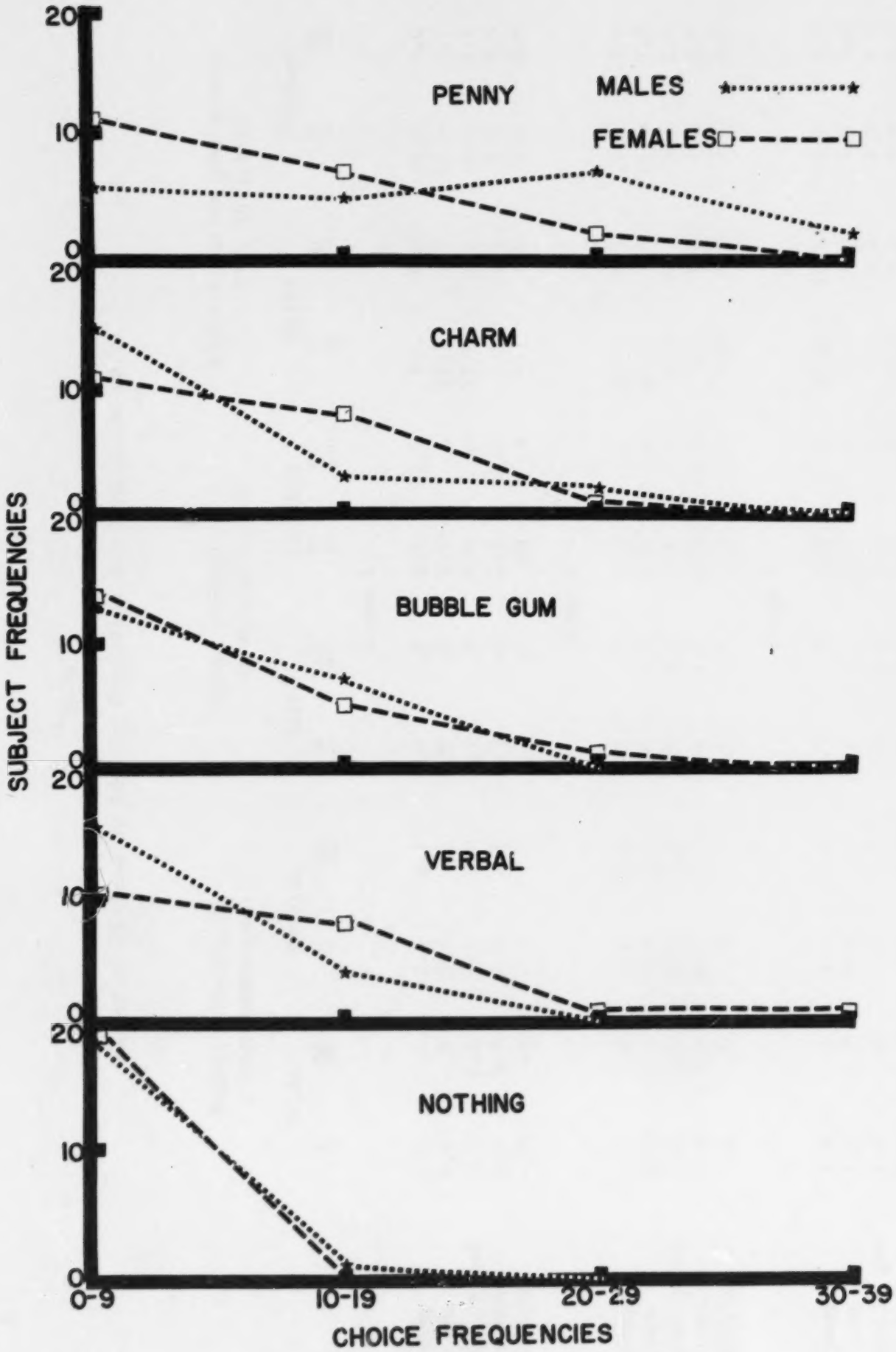

PENNY
MALES
FEMALES
CHARM
BUBBLE GUM
VERBAL
NOTHING
SUBJECT FREQUENCIES
20
10
0
0-9
10-19
20-29
30-39
CHOICE FREQUENCIES

Table 5

Number of Choices by Ranking Condition for Each Grade Level

	Paired comparison nonconsummation				Paired comparison consummation				Discrimination preference last 40 trials			
	Males		Females		Males		Females		Males		Females	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Grade 1												
Penny	2.6	.8	2.2	1.1	2.6	.8	2.4	1.0	9.4	4.7	10.6	4.0
Charm	2.6	.8	2.8	.8	2.8	.8	2.7	.6	13.4	6.6	11.4	4.7
Bubble gum	2.4	1.1	2.4	.9	2.5	.9	2.4	.6	10.0	6.2	11.4	3.7
Verbal	2.2	1.5	2.6	1.3	1.9	1.4	2.4	1.3	4.5	4.7	3.8	3.6
Nothing	.2	.4	.1	.2	.2	.4	.0	.3	2.7	2.6	2.8	2.4
Grade 3												
Penny	2.5	.8	2.2	1.0	2.7	.7	2.3	.9	13.0	6.7	12.6	5.7
Charm	2.4	1.2	2.6	1.0	2.7	1.2	2.9	.9	12.9	6.6	10.4	4.9
Bubble gum	2.6	1.2	2.2	.8	2.4	1.2	2.7	.8	8.3	4.2	9.7	3.0
Verbal	2.4	1.2	2.8	1.2	2.1	1.1	2.1	1.2	4.1	5.6	4.9	5.7
Nothing	.3	.6	.3	.7	.2	.4	.1	.3	1.8	5.6	2.5	3.0
Grade 5												
Penny	2.6	.8	2.4	.9	2.7	1.0	2.4	.9	17.2	10.8	10.8	6.2
Charm	1.8	1.2	2.4	.9	2.2	1.1	2.4	.8	7.4	6.9	9.4	4.0
Bubble gum	1.9	.8	1.6	1.2	2.2	1.0	2.0	1.1	7.8	4.0	8.8	4.4
Verbal	3.4	1.0	3.2	1.0	2.6	1.2	2.8	1.5	5.4	6.0	9.2	9.6
Nothing	.3	.5	.4	.7	.2	.6	.2	.6	2.0	3.0	1.6	2.4

Table 6

Rank Comparisons Over Task Conditions for Three Grade Levels

Incentive	Discrimination preference[a]		Paired comparison consummation		Paired comparison nonconsummation	
	Males	Females	Males	Females	Males	Females
			First grade			
Penny	3	3	2	3	1	4
Charm	1	1.5	1	1	2	1
Bubble gum	2	1.5	3	3	3	3
Verbal	4	4	4	3	4	2
Nothing	5	5	5	5	5	5
			Third grade			
Penny	1	1	1	3	2	4
Charm	2	2	2	1	3.5	2
Bubble gum	3	3	3	2	1	3
Verbal	4	4	4	4	3.5	1
Nothing	5	5	5	5	5	5
			Fifth grade			
Penny	1	1	1	2.5	2	2
Charm	3	2	3.5	2.5	4	3
Bubble gum	2	4	3.5	4	3	4
Verbal	4	3	2	1	1	1
Nothing	5	5	5	5	5	5

[a]Last 40 trials

been presented in Table 3 to demonstrate incentive rank agreement between subjects in each of the various age-sex populations for the discrimination preference task. Table 7 contains Kendall's mean consis-

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Insert Table 7

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tence coefficents, demonstrating individual consistencies (reliability) in avoiding circular triads (Edwards, 1957; Kendall, 1948), and Kendall's agreement coefficients, reflecting consensus between subjects, for particular populations under the two conditions of the paired comparison tasks. On the discrimination task, from Table 3, the concordance measures for the last 40 trials over all incentive conditions were .44 and .52, respectively, for males and females in the first grade; .48 and .39 in the third grade, and .38 and .31 in the fifth grade; the coefficients were statistically significant at the .01 probability level or less. The comparable agreement coefficients for paired comparisons in Table 7 ranged from .34 to .38 in Grade 1, .33 to .38 in Grade 3, and .31 to .44 in Grade 5, also statistically significant at or beyond .01 probability levels. The means of individual consistence scores for the different populations under the paired comparison conditions appear impressively stable from Table 7, with values ranging between .79 and .93.

Incentive rank consistency by individual subjects across the two paired comparisons and the discrimination preference conditions was determined by Spearman rank-difference correlation coefficients (rho). This measure provided an estimate of the validity of the paired comparison approach, employing the more demanding (effortful learning) discrimination task as a criterion. Rho coefficients were calculated on the five incentive ranks for each subject across the three ranking condition combinations: (a) discrimination task--paired comparisons (nonconsummation), (b) discrimination task--paired comparisons (consummation), and (c) PC (consummation)--PC (nonconsummation). Every subject's rho coefficient was converted to an exact probability which was in turn transformed to a $\bar{U}$ score (Tippett, 1952). This procedure makes it feasible to sum the individual rho probabilities and test the null hypothesis that a distribution of rho coefficients might have occurred by chance; a chi square test yields the probability value. Mean rho values of distributions for each age-sex group, obtained from calculating correlations on individual subjects across the three ranking conditions, are presented in Table 8. Significance values attached to the

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Insert Table 8

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means in the table are a function of the total distributions of rho coefficients; the artifact was introduced for economy of tabular presentation to demonstrate substantial congruence across the three conditions in all samples. This modification is particularly important in reading what appear to be inconsistent probability values from the table;

Table 7

Summary of Kendall's Coefficients of Consistence and Agreement on Paired Comparison Tasks for Three Grade Levels

Measure	Paired comparison consummation		Paired comparison nonconsummation	
	Males	Females	Males	Females
	First grade			
Kendall's mean consistence	.89	.79	.91	.93
Kendall's agreement	.37**	.35**	.34**	.38**
	Third grade			
Kendall's mean consistence	.90	.84	.85	.84
Kendall's agreement	.34**	.38**	.33**	.35**
	Fifth grade			
Kendall's mean consistence	.87	.82	.93	.86
Kendall's agreement	.31**	.34**	.44**	.34**

**Significant at .01 level.

Table 8

Mean Rho Values Between Ranking Conditions for Three Grade Levels

(N=20 per Age-Sex Group)

Condition combination	Males	Females
	First grade	
Discrimination preference with PC (consummation)	.42[b]	.40[b]
Discrimination preference with PC (nonconsummation)	.41[a]	.50[c]
PC (consummation) with PC (nonconsummation)	.80[c]	.76[c]
	Third grade	
Discrimination preference with PC (consummation)	.46[b]	.56[c]
Discrimination preference with PC (nonconsummation)	.38[c]	.40[c]
PC (consummation) with PC (nonconsummation)	.70[c]	.72[c]
	Fifth grade	
Discrimination preference with PC (consummation)	.54[c]	.58[c]
Discrimination preference with PC (nonconsummation)	.44[a]	.38[b]
PC (consummation) with PC (nonconsummation)	.74[c]	.66[c]

[a]Significant at .05 level.

[b]Significant at .01 level.

[c]Significant at .001 level.

such instances stem from the nature of the rho distributions not always entirely consonant with values suggested from the means.

The ranks were approximately comparable across task conditions, as reflected in the statistically significant values for all age-grade sample comparisons in Table 8. The mean intercorrelations for the two paired comparison conditions were higher, ranging from .66 to .80, than were those for either PC form with the discrimination task, where the mean rho coefficients ranged from .38 to .58. Except in Grade 1 there was a slight tendency for the mean correlations to be higher between discrimination preference incentive rankings and PC with, rather than without, consummation.

The significant relationships of discrimination preference to the PC tasks are impressive in spite of one strong attenuating factor; in many of the samples the verbal incentive was ranked at or near the top of the scale on the PC tasks, but near the bottom on the discrimination task. Referring back to Table 6, this incongruence is particularly apparent for females at all grade levels in according high rank to verbal on the PC nonconsummation scale, and the same contrast prevailed for both males and females in Grade 5 on the two PC forms, high verbal values juxtaposed to lower ranks on discrimination preference. General consistency across tasks, nevertheless, remains impressive despite the verbal inconsistencies, differential reinforcement consummation opportunities for the subjects, instruction differences across tasks, close spacing of the material incentives, and the varying demands consequent from experimental conditions.

Age Trends

Developmental trends for incentive choices across task conditions are depicted as approximately similar by the three ranking procedures in Figure 6 for the age-sex samples. Scale comparability is arbitrarily

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Insert Figure 6

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represented and limited by the following considerations. Total choice frequencies for the paired comparison conditions are indicated on the left of the ordinate; each subject could make 10 choices in all, with a maximum of four per incentive. On the discrimination task, the total frequencies are represented to the right of the ordinate for the last block of 20 trials; thus, each subject had 20 choices, and, while he could conceivably allocate them to one incentive, some distribution across rewards was more likely. The resulting 2 to 1 scale ratio should not be interpreted literally, rather Figure 6 should be scanned for developmental similarities and closely inspected for incentive ranks within task conditions for specific samples.

Similarity in age progression for the verbal incentive is particularly striking in Figure 6. These trends are partially confirmed from

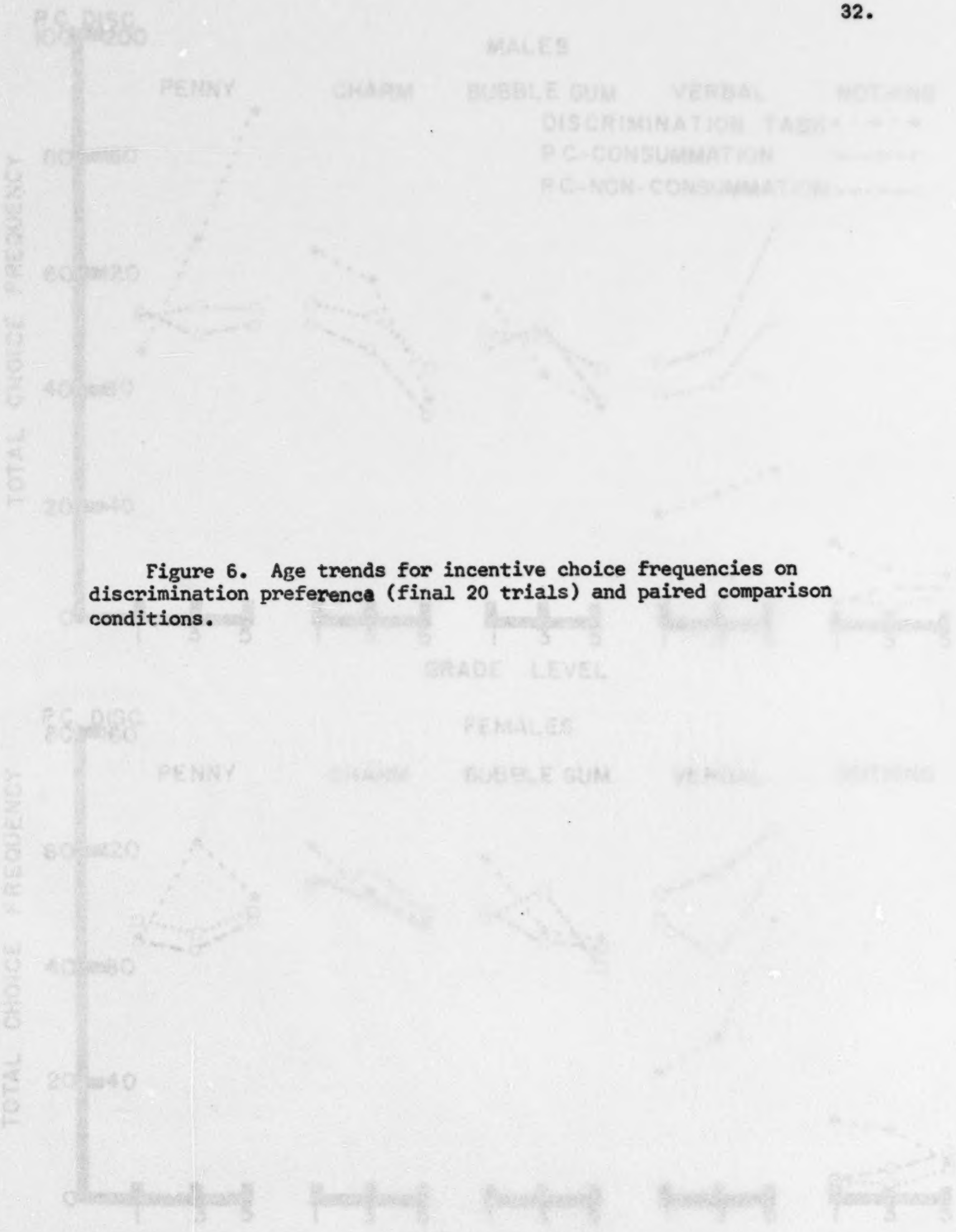
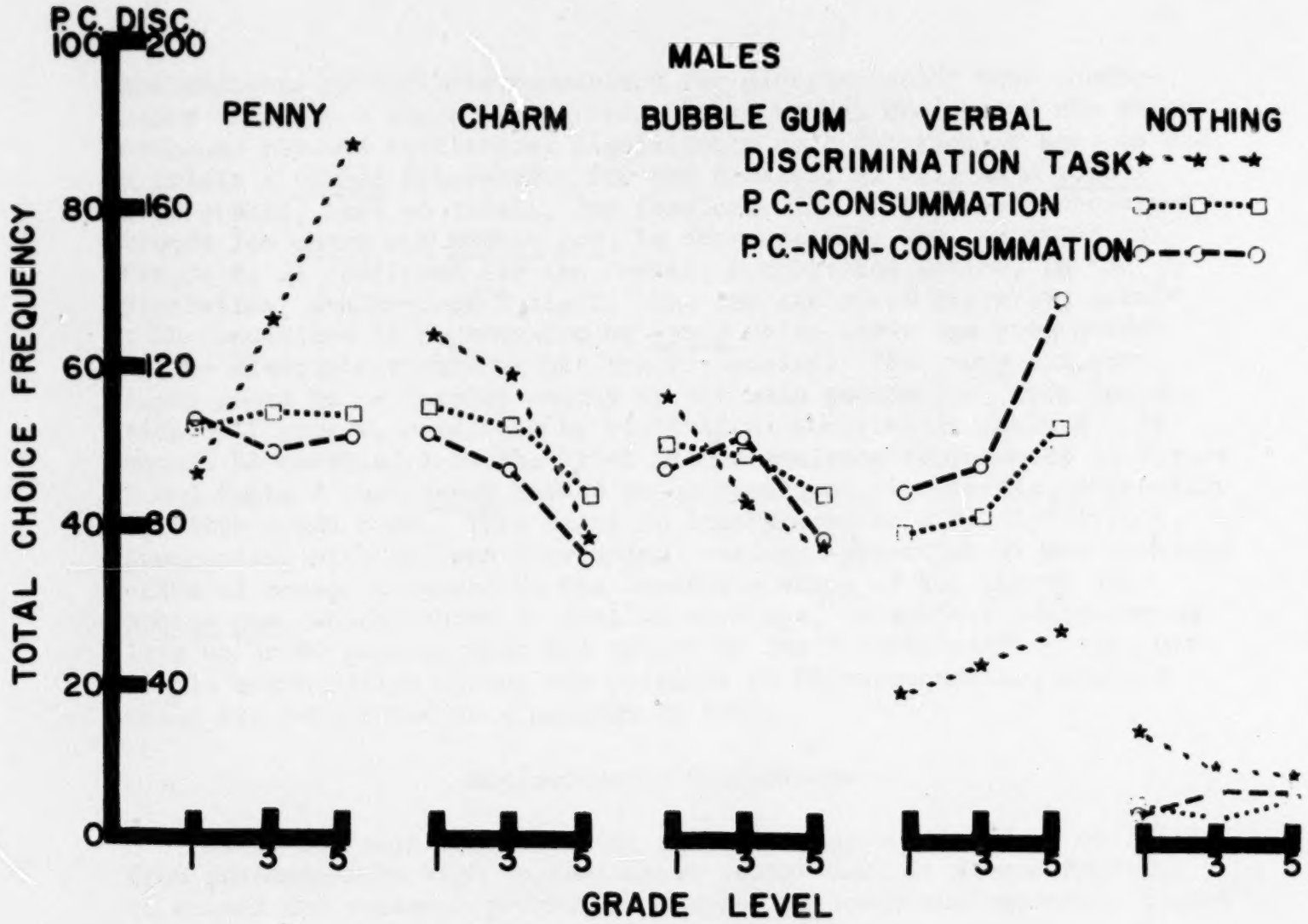
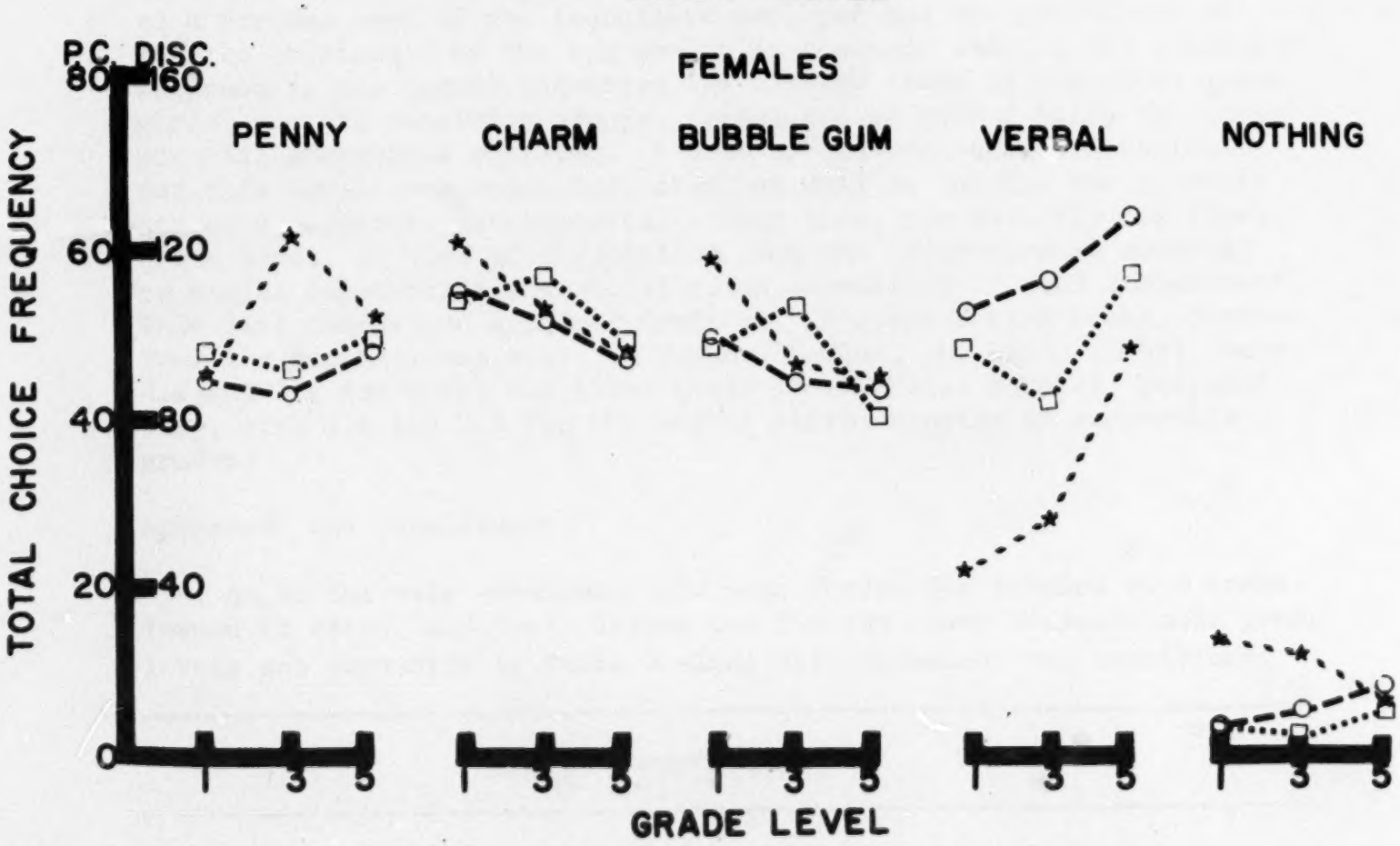


Figure 6. Age trends for incentive choice frequencies on discrimination preference (final 20 trials) and paired comparison conditions.


P.C. DISC.
100
200
MALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
DISCRIMINATION TASK
P.C.-CONSUMMATION
P.C.-NON-CONSUMMATION
TOTAL CHOICE FREQUENCY
80
160
60
120
40
80
20
40
0
1
3
5
GRADE LEVEL


P.C. DISC.
80
160
FEMALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
TOTAL CHOICE FREQUENCY
60
120
40
80
20
40
0
1
3
5
GRADE LEVEL

the analyses of variance summarized for discrimination task performance in Table 2 where total trial blocks verbal choices of the sexes combined reached statistical significance as a function of age, as did a trials X verbal interaction for the females, as well as a verbal over grades, last 40 trials, for females. The slight, but consistent, trends for charm and bubble gum, to decrease with age, as shown in Figure 6, is confirmed for the former, but not the latter, in the statistical analyses of Table 2. The one age trend disparity across task conditions is represented by penny which shows age progression on the discrimination, but not the PC, scales. The penny age variance seems to be carried mainly by the male population, from inspection of Figure 6, confirmed by statistical analyses in Table 2. It should be recalled from the trial blocks analyses represented in Figure 2 and Table 2 that penny tended to be cumulated over trials, especially by fifth grade boys. This might be interpreted as a "kitty" effect, progressing with age and increasing rational powers about the exchange value of money, compared to the immediate value of the charms and bubble gum, which tended to decline with age. A subject could accumulate up to 80 pennies over all trials on the discrimination task, but little accumulative effect was possible on PC consummation, where a child was restricted to a maximum of four.

Socioeconomic Comparisons

Since the main sample of the present study consisted of children from predominantly high socioeconomic background, it seemed fruitful to extend the research program to samples of lower socioeconomic status as a further test of the techniques employed and the generality of results obtained. Of the six groups in the main sample, the strongest response to the verbal incentive was clearly shown by the fifth grade girls; for the remaining groups, verbal praise ranked below the three material incentives employed. A test of the socioeconomic variable for this sample was hence indicated, as well as one for the opposite sex at a different developmental point; thus, the selection of first grade boys. In view of suggestions from the literature on material or social deprivation and social class correlates of need achievement, this last comparison appeared fruitful. Average status ranks, derived from the occupational scale by Warner, Meeker, and Eells (1949), were 4.2 and 5.1 for first and fifth grade lower status samples, respectively, with 1.4 and 2.2 for the higher status samples in comparable grades.

Agreement and Consistency

As in the main experiment raw mean scores for samples were transformed to ranks, and these values for the two lower socioeconomic grade levels are presented in Table 9 along with agreement and consistency

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Insert Table 9

Table 9

Rank Comparisons, Agreement and Consistency Measures by Condition

(Lower socioeconomic class)

Incentive	Discrimination preference last 40 trials		Paired comparison consummation		Paired comparison nonconsummation	
	First grade males	Fifth grade females	First grade males	Fifth grade females	First grade males	Fifth grade females
Penny	1	1	2	1.5	4	3
Charm	2	3	1	1.5	1	2
Bubble gum	3	4	3	4	3	4
Verbal	4	2	4	3	2	1
Nothing	5	5	5	5	5	5
p values, rank Significance	.001	.001				
Kendall's W (concordance)	.36**	.31**				
Kendall's mean consistence			.93	.85	.79	.87
Kendall's agreement			.36**	.30**	.23**	.37**

**Significant at .01 level.

measures within ranking conditions. Under the discrimination preference columns the probability values and concordance coefficients derived from Friedman's two-way analysis of variance reflect statistically significant ranking arrangements for the samples similar to the comparable populations in the main experiment. Individual and group consistencies and agreement are also apparent for the PC conditions, employing Kendall's appropriate coefficients. Close inspection of Table 9 reveals a slight tendency for consistence and agreement measures to be smaller for first grade boys under the PC nonconsummation condition, and this particular population should bear particular scrutiny in the subsequent analyses.

This last consideration warrants immediate attention in Table 10

Insert Table 10

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which summarizes individual subject intercorrelations (rho's) across ranking conditions. The rho distributions were comparable in significance values to those obtained in the main experiment (compare Table 8), except for the failure of statistical significance when comparing discrimination ranks with PC nonconsummation ranks for the lower status first grade boys. Lack of significance for this particular intercorrelation distribution was the unique exception from 24 analyses in the total experiment, 18 mean rho's in Table 8 and 6 in Table 10.

Differences between Social Classes

The major comparisons between social classes in this section will be based upon discrimination preference choice behavior, the criterion measure; a few comments should suffice for the PC rank similarities between Table 6 (upper status) and Table 9 (lower status). Results for both classes in the two age-sex samples were quite comparable, but once more the lower socioeconomic first grade boys provided an exception. Under nonconsummation the lower class boys ranked verbal high (second) and penny low (fourth), but they reversed under consummation with verbal ranking fourth and penny, second. No such reversal occurs for upper class boys who ranked verbal praise fourth under both conditions. It can be speculated whether lower class boys responded to material deprivation under consummation or social deprivation under nonconsummation or both. It is also interesting that the discrimination ranks are compatible with the PC consummation scale.

The pronounced similarity between social classes for incentive learning and preference effects on the discrimination task is observed in Figure 7, where the trial block curves and terminal block frequen-

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Insert Figure 7

---

cies are so overlapping that one population practically serves as a

Table 10

Mean Rho Values between Ranking Conditions for

Lower Socioeconomic Class Groups

(N=20 per group)

Condition combination	First grade Males	Fifth grade Females
Discrimination preference with PC (consummation)	.46*	.48**
Discrimination preference with PC (nonconsummation)	.18	.48**
PC (consummation) with PC (nonconsummation)	.66**	.76**

*Significant at .01 level.

**Significant at .001 level.

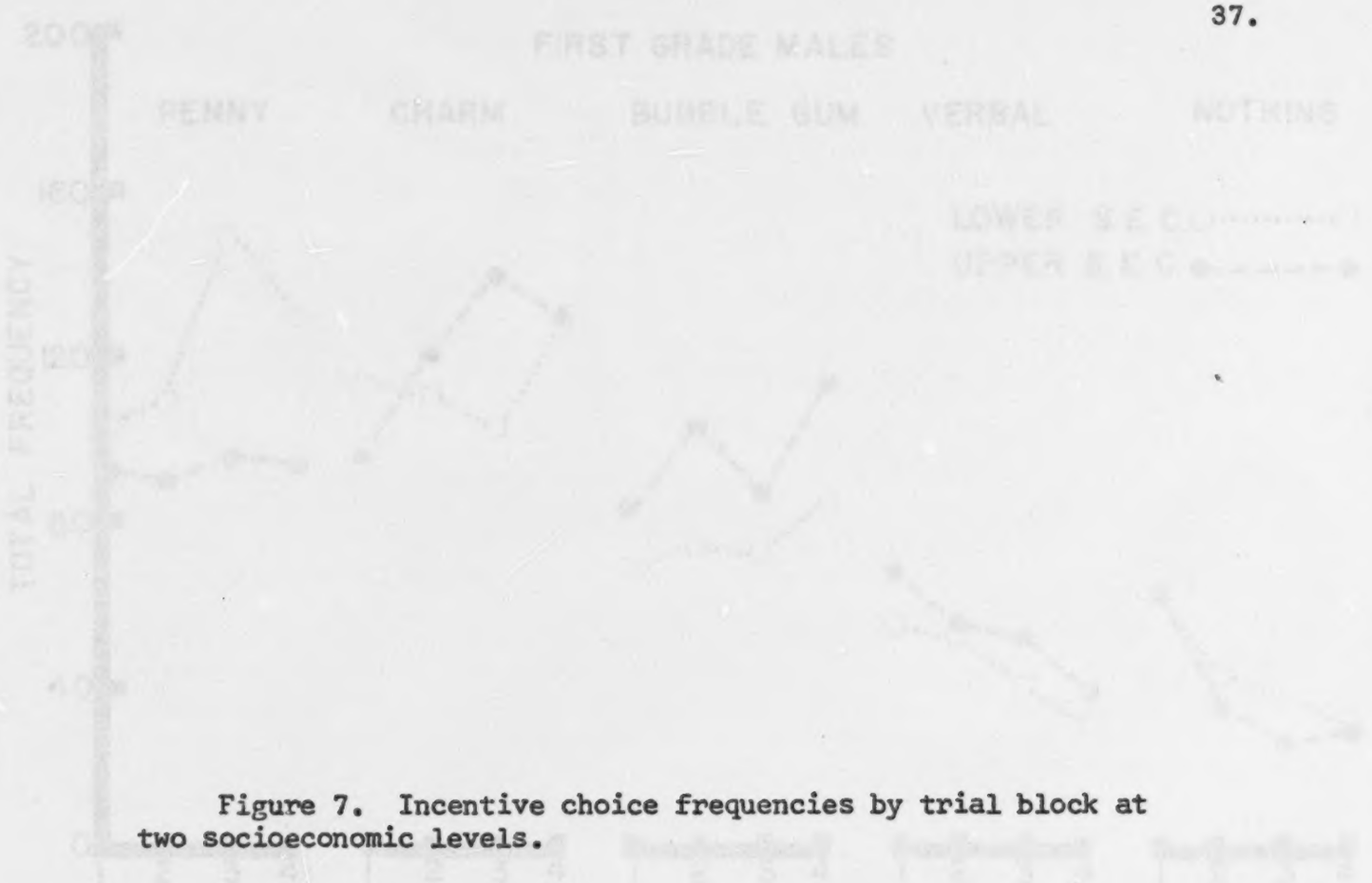
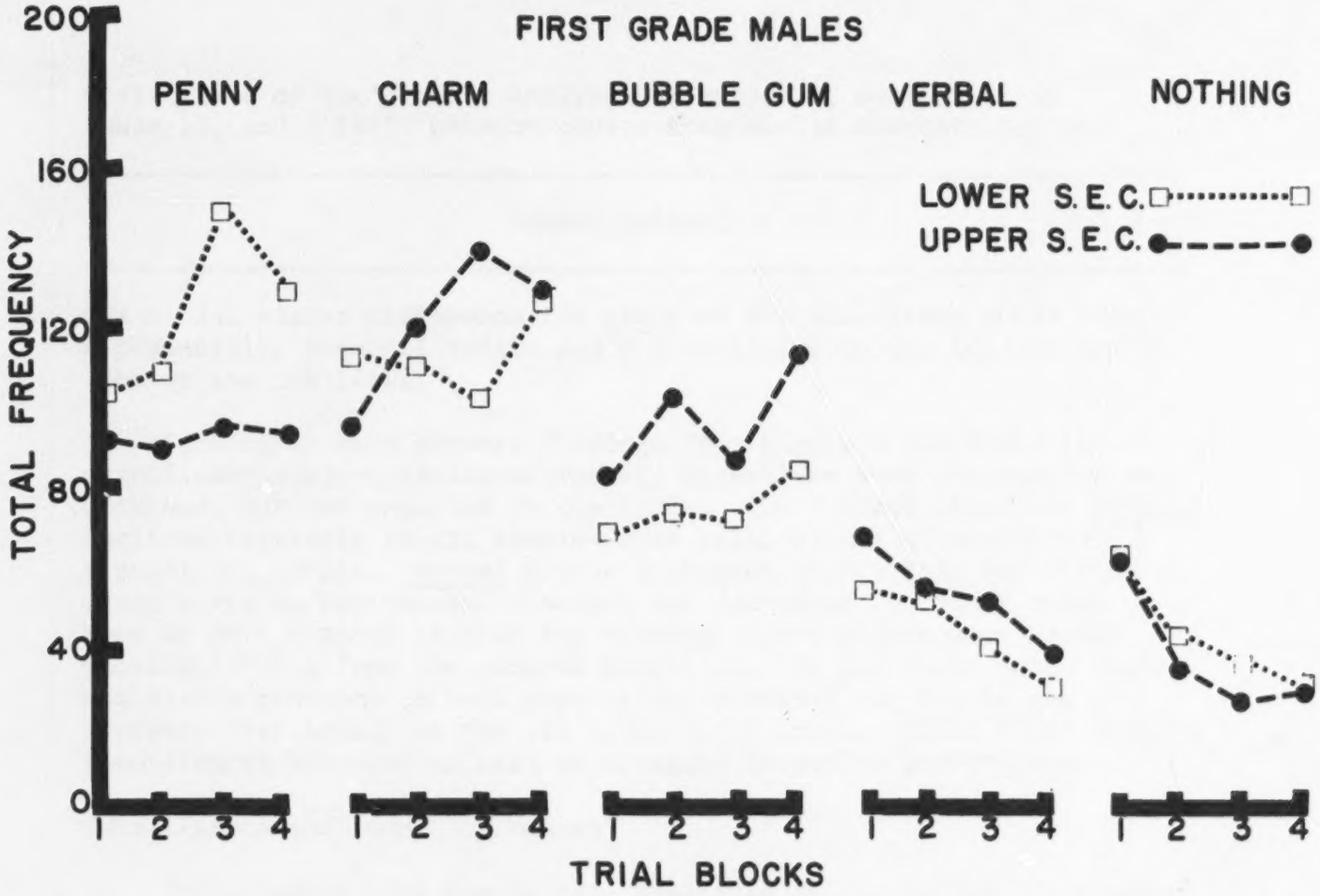
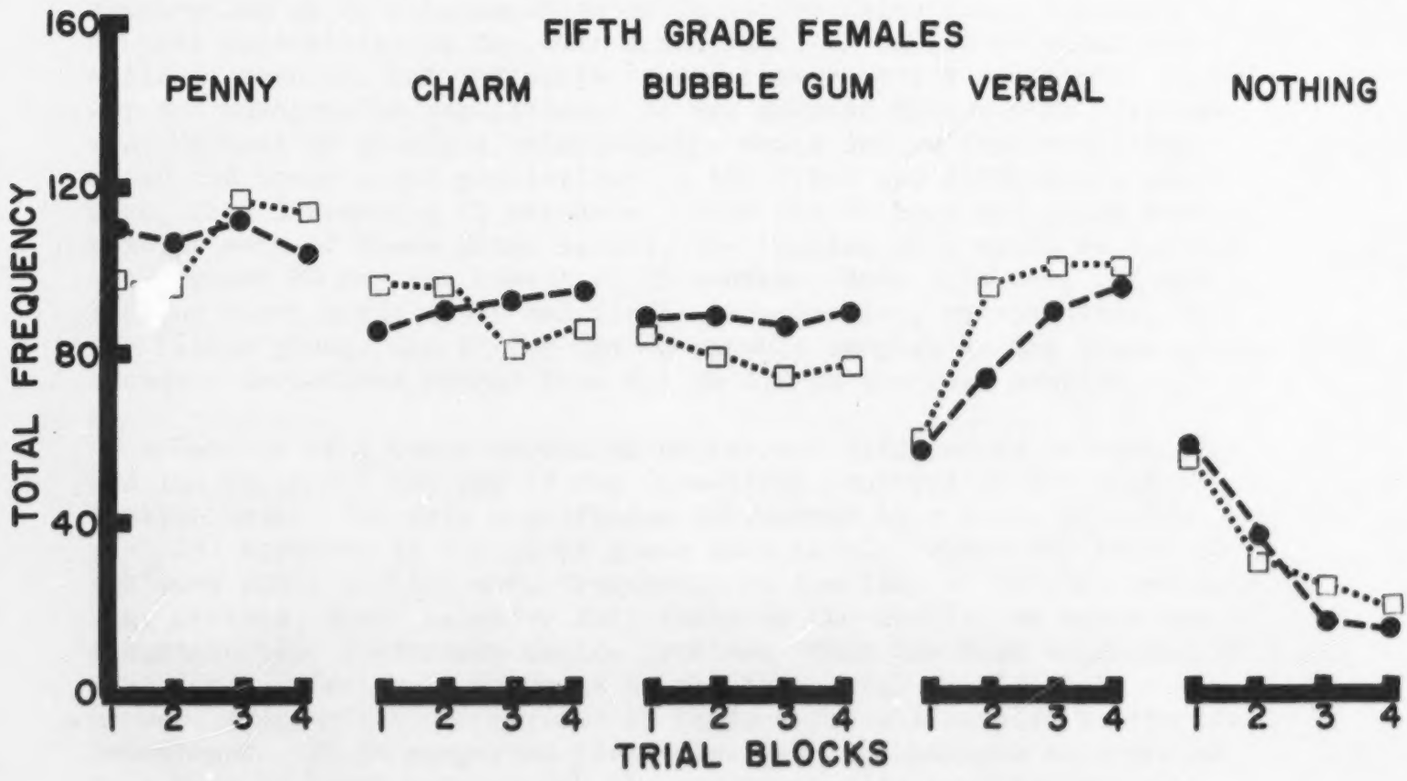


Figure 7. Incentive choice frequencies by trial block at two socioeconomic levels.


FIRST GRADE MALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
LOWER S. E. C.
UPPER S. E. C.
TOTAL FREQUENCY
200
160
120
80
40
0
1 2 3 4
TRIAL BLOCKS


FIFTH GRADE FEMALES
PENNY
CHARM
BUBBLE GUM
VERBAL
NOTHING
TOTAL FREQUENCY
160
120
80
40
0
1 2 3 4
TRIAL BLOCKS

replication of the other. Analyses of variance, summarized in Table 11, and *t* tests between choice frequencies demonstrated only

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Insert Table 11

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one social status difference for penny at the male first grade level; *F* probability over all trials and *t* probability on the last 40 trials were at the .05 level.

Turning to more general findings from Figure 7 and Table 11, significant subject variances for all incentives over all samples were obtained, but not reported in the table. The control condition nothing declined regularly in all samples over trial blocks at statistically significant levels. Verbal praise increased over trials for fifth grade girls in both social classes, but decreased for first grade boys in both samples so that the terminal block points were hardly distinguishable from the control condition. In the first grade there was also a tendency in both populations combined for bubble gum to increase over trials at the .05 probability level. Trial block effects demonstrated learning as well as changing incentive preferences.

Intelligence and Incentive Values

Intelligence test scores were available on the Pintner-Cunningham Primary Test in the first grades and the Otis in the fifth grades for examination of IQ relationships to incentive valuation. Exploration of this possibility in the main experiment had failed to yield significant results, but the subjects had represented a relatively superior and homogeneous population. It was assumed that a more discriminating test of possible relationships would derive from combining upper and lower class populations in the first and fifth grade samples, thus increasing IQ variance. From the 40 boys and girls available at each of these grade levels, the samples were split to reflect the highest 20 and the lowest 20 IQ scores. Mean IQ's were 123 and 119 for first grade males and fifth grade females, respectively, in the higher group, and 99 for the comparable samples in the lower group; standard deviations ranged from 5.3 to 6.8 in the four samples.

Results of *t* tests showed no preference differences between high and low IQ groups for any of the incentives employed in the discrimination task. The only significant difference ($t = 1.86$, $df = 38$, $p = .05$) occurred in the first grade male sample, where the lower IQ subjects chose nothing more frequently on the last 40 trials, reflecting, perhaps, their relative deficiency in the ability to solve the discrimination preference choice problem. This was also suggested in relatively inferior performance on the five trial recall task, a rigorous learning test summarized in Table 4 for all samples in the total experiment. It is suspected that these results indicate an approach to a base MA level below which the discrimination task becomes increasingly insoluble.

Table 11

Summary of Significant Analysis of Variance Results for Comparing Socioeconomic Classes on Discrimination Task

Source of variance	First grade males df	First grade males F	Fifth grade females df	Fifth grade females F
Lower class				
Verbal over trial blocks			3/57	6.54**
Nothing over trial blocks	3/57	4.77**	3/57	14.74**
Lower and upper classes combined				
Penny between classes	1/38	4.24*		
Bubble gum over trial blocks	3/114	2.77*		
Verbal over trial blocks	3/114	5.35**	3/114	9.68**
Nothing over trial blocks	3/114	12.83**	3/114	37.51**

Note - Significant subject variances obtained for every incentive condition are excluded as in Table 2.

*Significant at .05 level.

**Significant at .01 level.

The uniformity of incentive rankings over various samples differing in age, sex, and socioeconomic status and the substantial correlations among three task conditions were the most striking findings from this investigation. This congruence over samples and experimental measures was especially impressive in view of the characteristically closely spaced scale positions for three of the rewards, the material incentives, sometimes including the fourth, verbal praise; individual differences significantly associated with every incentive condition and the control further confounded the likelihood of obtaining the uniformities indicated.

A few parametric influences upon incentive scores did obtain. The values for penny and verbal increased with age, while charm decreased somewhat on the discrimination preference task. The penny increase, most pronounced for males on the discrimination task, did not appear in either of the two paired comparison conditions. Polidora and Schneider (1964), experimenting on monkeys, concluded that paired comparisons yielded better estimates of initial preference than did operant response procedures. As indicated earlier, subjects could cumulate pennies over trials in the discrimination task at a theoretical 20 to 1 ratio to the PC conditions, suggesting a "kitty" effect to which children are increasingly sensitive with age.

The decline with age of charm and bubble gum reflects some diminshed valuation, but many older children continued to select these rewards in substantial numbers. The verbal increase with age, most apparent for females in discrimination preference choice behavior, followed essentially the same trend in the PC tasks, but the initial positions with the latter in the first grade were much higher in rank, a point to be considered later. The age progression for verbal praise runs counter to social deprivation theory which suggests younger children are more dependent, but is in accord with internalization notions that older children develop increasingly strong secondary and "tertiary" reinforcement values. That this generalization is not limited to the upper middle class population of the main experiment is confirmed by the highly similar findings for first grade males and fifth grade females of lower social status.

Another interpretation of the age trend for verbal reinforcement stems from the strong responses of upper and lower class fifth grade females, much of which we are tempted to attribute to the cross-sexual influence of two handsome male experimenters--the junior authors; the girls were approaching pubescent age in a cultural period when social adolescence seems to be extending developmentally downward. Not all of the variance can be so attributable, for the male age trends over ranking conditions, while not so pronounced, were similar; this should be tested on lower social class male groups developmentally. Additional evidence of verbal reinforcement progression with age is contained in the paired comparison study by Witryol and Ormsby (1961) where the developmental change was even more marked, probably a consequence of the nature of the verbal reinforcements related to the instructional set. Moreover, the "greediness" of some young children for material rewards was inferred by Fischer (1963) from his research on sharing habits in nursery school children.

The Nickell and Travers (1963) study over a broad developmental range reflected superiority of material, as compared to verbal, reinforcement with no important age trends on a spatial discrimination task, employing the differential method. Although this investigation is closely related to the present one, two important features of difference should be noted; reinforcement was delivered on 50% of the trials, and marble rewards might have been perceived as exchangeable for candy and toys obviously displayed. The partial reinforcement schedule combined with the relative ambiquity of trading "good" for the incentives might have operated more adversely for the verbal rewards than in the present study.

The verbal incentive of the present investigation, while increasing in value with age, almost always ranked below the material rewards, except in the case of fifth grade girls, already noted for discrimination learning, and in certain samples under paired comparison conditions; high rank was accorded verbal by both sexes in the fifth grade under two PC conditions, and by first and third grade girls under PC nonconsummation. Instructions and task relevance seem crucial to account for inconsistencies of verbal ranks. The observations from our preliminary report (Witryol, Tyrrell, & Lowden, 1964) are relevant:

"In the more social face-to-face paired-comparison administration, E instructed S to select on the basis of, '...would you rather have a penny or your mother or teacher tell you that you have been a very good boy?' This instruction could not be duplicated in the discrimination task where approval of necessity was phrased differently and where S, upon selecting a stimulus pattern, immediately saw an empty well before, or at best, simultaneously to administration of verbal reinforcement by E who sat behind a one-way screen. Verbal approval is sensitive to task relevance and a wide variety of other parameters (Stevenson, 1961; Stevenson, Keen, & Knights, 1963; Zigler & Kanzer, 1962). In testing verbal against material incentives in an experiment situation, instrumentation of the former is difficult to achieve in a manner precisely comparable to the latter, a problem we are currently trying to solve.

"In connection with the PC instruction-induced set, the cogent assumptions of Kausler and Trapp (1960) seem relevant. They have contended that incentive-oriented sets have associative, but not drive properties and specifically energize goal relevant responses, whereas generalized drive tends to energize indiscriminately. In another experimental context Aronfreed, Cutick, and Fagen (1963) reached the conclusion that explicit cognitive structure and timing in the administration of social reinforcement are the critical features for determining appropriate responses. In the PC set the children may have been more verbal incentive-oriented as a consequence of the instructions which pointed up what parents and teachers more ordinarily do, dispense verbal approval rather than plastic cows or bubble gum or pennies, whereas, in the discrimination task, incentive expectations K may have been more nearly additive to generalized drive as Spence (1956) has suggested.

"Brush et al. (1963) reached the conclusion that past motivation level or history may be more important than incentive strength in the experiment per se. Differential past learning of incentive motivation K would then be a powerful determinant of drive level in research with children, and the procedures in the present study could provide an initial measure of this level for particular subjects or subject groups. This is especially important when employing verbal social reinforcements where there are, as suggested by Kanareff and Lanzetta (1963) problems of multiple determinants and, as defined by Feather (1959; 1962), intricate interactions between motive strength, expectation, and incentive value."

Past motivation history with respect to the types of incentives employed in the present experiment was significantly manifested by the strong individual differences obtained for every reward value. Sex differences, however, were infrequently observed, the most important being the tendency of fifth grade boys to cumulate pennies while the fifth grade girls were cumulating verbal reinforcement over trials in discrimination learning. Of little psychological significance was the third grade girls' slight preference for plastic cows, when the boys were similarly leaning toward bubble gum. More unexpected was the similarity approaching identity for results on two age-sex samples of widely different social status; the only class difference was the greater attraction of pennies for lower class boys in the first grade. Furthermore, no IQ variance was obtained when polar social status samples were collapsed to analyze intellectual scores for extreme groups.

As the differential method has been employed in this study no clear analytic distinction can be made between learning and incentive preference scores; only scores for the latter were available. However, learning had to take place on the discrimination task to get trial block variances demonstrated, especially the invariant drop for the control condition, nothing, in all samples. Rank differences from initial to terminal trial blocks provided more evidence, as did positive results on the rigorous five trial recall test at the end of the experiment. Finally, substantial rank agreement across preference measures served as empirical and construct validation for each of the three approaches.

Not systematically clear from analysis of the discrimination task is change in strategy of choice behavior over trials to reflect satiation after consecutive strings, or need to alternate in selecting rewards. Individual subjects did select across incentives, possibly for variety of reward acquisition, and this is demonstrated by close spacing frequently indicated in group scale positions. Other children stayed with one reward and only occasionally departed from this pattern. The cumulation of pennies and verbal reinforcement over trial blocks in selected samples is provocative, as is the significant tendency of all first grade populations to decrease their choices for verbal, while older children at least maintained rank position on this incentive over trials. Further research is planned on more extended trial sequences with fewer incentives in order to study this particular choice strategy parameter.

The findings from this research are compatible with other studies, if one recalls admonishments suggested in the literature review. Age, sex, task, and socioeconomic parameters should always be carefully considered, but results from this experiment indicated strong generality across these variables. Individual reinforcement history is critical. Although the present investigators are inclined, in accordance with the inferences drawn from the Goldstein-Spence (1963) and Davenport (1962) studies, to the view that the absolute and differential methods lead to comparable findings on reinforcement with discrimination learning, much more research is needed, as examination of the Pubols review (1960) made clear. Extension of the absolute and differential methodologies to the study of children's incentives seems fruitful. Still to be clearly analyzed is the impact of different incentive values on various measures of learning and performance; indeed, a clear demonstration of influences on acquisition or habit by varying reinforcement is not presently available in child psychology research.

Perhaps the most compelling consideration derived from our research experience is the significance of instructional set for relating the demands of the task and the reinforcements administered to the considerable incentive history a child brings to the experimental situation or indeed carries around in the "real" world. This was indicated in differences obtained between PC and discrimination measures for verbal rewards. When verbal reinforcement becomes more relevant to the task problem, its value is enhanced as in the PC measures. This last scale provides a good measure of initial preference values and seems to have been validated by the discrimination task. The discrimination problem, in turn, employing subjects as their own controls in the differential method, appears to be an economical alternative to the absolute method which requires a larger number of populations; the present research program would have required an impractical multitude of samples and trememdous labor by the absolute method with two sexes over three grade levels and two socioeconomic comparisons for four incentives, accompanied by the two PC conditions. Findings with the differential method were remarkably stable considering individual differences, incentive value similarity, and the number of complex parameters just stated.

VII. Summary

Incentives administered to 160 children were ranked by means of a five choice discrimination task (differential method) with simultaneous reinforcement and by two paired comparison scales for four representative reward types over six age-sex and two socioeconomic samples. Measures of agreement across ranking conditions were substantial, and incentive ranks were congruent over age, sex, and socioeconomic status with few exceptions. Material reinforcements were generally accorded higher rank positions, but verbal incentives increased in value with age. While individual differences were large, there were few sex and socioeconomic, and no IQ, differences. The paired comparison approaches seemed to be validated, as initial incentive preference measures, by discrimination preference choice behavior which was recommended as an economical alternative to the absolute method. Task and instruction parameters were suggested as sources of incentive valuation variance, especially for verbal reinforcement. 58 references.

Appendix 1

Discrimination Preference Choice Behavior Instructions

The S was seated in front of the apparatus with the tray pulled to the E side of the apparatus.

"Now we are going to play this game. When the game starts I will be behind this screen where you won't be able to see me. When I am behind it I am going to push this tray forward so that you will be able to see these pictures. (Demonstrate by pushing tray and pointing to stimulus patterns.) Each time I push the tray forward, you may pick one of the pictures, and look under it. If there is something under the picture you pick, you may put it in your bag to take home with you. Now remember each picture will always have the same thing under it, and you may pick only one picture each time."

After the tenth trial E repeated, "Remember each picture will always have the same thing under it."

Verbal Reinforcers

The first reinforcement was administered for the first two verbal incentive choices; the remaining three, and the first, were subsequently delivered at random when the appropriate stimulus was selected.

1. "Good boy (girl), I am very glad you picked that one. It makes me very happy, even though there is nothing under it. Very good!"

2. "Thank you very much for picking that picture. I like it when you pick that one."

3. "Good boy (girl). It makes me very happy when you pick that one."

4. "Fine; that's the one I like."

Appendix II

Recall Test Instructions

While tray is on the E side of apparatus:

"This time let's do it differently. When I push the tray out, I want you to point to the picture that had the _____ (named incentive) under it. Don't pick it up, just point to it."

Push the tray to the S and repeat:

"Can you point to the picture with _____ under it? Remember just point to it. Don't touch it."

Repeat last instruction for each incentive every trial. Then rearrange stimulus-incentive positions and begin next trial.

"Remember just point to it. Don't touch it."

Repeat for a total of five trials, 5 incentive identifications each, 25 identifications in all.

Appendix III

Instructions for Paired Comparisons

"I would like to play a game with you. The game is called: Which would you rather have, or Which do you like the most?

"I will show you two things and you are to tell me which you like the most. Then I will show you two more things and you will tell me which of those you like the most. We will do this until the game is over.

"Here are the first two things; which would you rather have, a (penny) or (have your mother or teacher tell you that you have been a very good boy)."

Before each choice repeat, "Which would you rather have?"

Nonconsummation

1. Penny--you have been a very good boy (girl)
2. Bubble gum--nothing
3. Charm--penny
4. You have been a very good boy--bubble gum
5. Nothing--charm
6. Bubble gum--penny
7. Nothing--you have been a very good boy
8. Charm--bubble gum
9. Penny--nothing
10. You have been a very good boy--charm

Consummation

Now we will do the same thing, only each thing you pick you may put into your bag.

1. Penny--verbal
2. Bubble gum--nothing
3. Charm--penny
4. Verbal--bubble gum
5. Nothing--charm
6. Bubble gum--penny
7. Nothing--verbal
8. Charm--bubble gum
9. Penny--nothing
10. Verbal--charm

SCORE:	Nonconsummation	Consummation
Bubble gum	_____	_____
Penny	_____	_____
Charm	_____	_____
Verbal	_____	_____
Nothing	_____	_____

Name _____ Subject #_____

Grade_____

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